THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 45. Thursday, August 13, 1931. No. 782.

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial: 17s. 6d. per annum.
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, or to the Publisher, as the case may be, of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2.

Telegraphic Address: "Zacatecas, Rand, London."
Telephone: Temple Bar 3051 (5 lines).

Contents.

	PAGE
The Vindication of the Casting	95
It Would not be Done!	95
F.C.I.R.A.	95
The British Cast Iron Research Association	96
International Foundry Exhibition and Congress, Milan	96
Random Shots	96
Sand Testing	97
Some Notes on the Law Affecting the Sale of Goods	98
Prizes of International Aluminium Competition Awarded	98
The New Montreal Foundry of the Canadian National Railway Company	99
Iron and Steel Production	101
Catalogue Received	101
High-Test and Alloy Irons	102
Famous Men of Carron	104
Book Review	104
Refractory Materials for the Induction Furnace	105
Modern Nitriding Practice	107
Overseas Trade Development Council	107
Technical Co-operation	108
A New Commercial Delivery Van	108
Correspondence	108
Trade Talk	109
Personal	109
Obituary	109
A Co-operative Window Display	109
Iron and Steel Markets	110

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.

Institute of British Foundrymen.

PRESIDENT: 1931-32:
A. Harley, The Daimler Company, Limited, Daimler Works, Coventry.

LIST OF SECRETARIES—

General Secretary: T. Makemson, Saint John Street Chambers, Deansgate, Manchester. London Office: 49, Wellington Street, London, W.C.2.

Birmingham: F. K. Neath, 24, St. Paul's Square, Birmingham.

Sheffield: T. R. Walker, 33, Ladysmith Avenue, Nether Edge, Sheffield.

Scottish: J. Bell, 60, St. Enoch Square, Glasgow.

Lancashire: J. E. Cooke, 1, Derbyshire Crescent, Stretford, Manchester.

London: Sydney Evans, 22-23, Laurence Pountney Lane, Cannon Street, London, E.C.4.

Newcastle-upon-Tyne: J. W. Eckford, 4, Mosely Street, Newcastle-upon-Tyne.

East Midlands: H. Bunting, 82, Otter Street, Derby.

West Riding of Yorkshire Branch: S. W. Wise, 110, Pullan Avenue, Eccleshill, Bradford.

Wales and Monmouth Branch: J. J. McClelland, 12, Clifton Place, Stow Hill, Newport, Mon.

Middlesbrough: F. A. Harper, "The Briars," Bishopton Road, Stockton-on-Tees.

Foundry Trades' Equipment and Supplies Association.

President: D. H. Wood,
Titan Works, Charles Henry Street, Birmingham.

Secretary: K. W. Bridges, Grand Buildings, Trafalgar Square, London, W.C.2

Welsh Engineers' and Founders' Association.

Secretary: E. J. Griffiths, 2, Royal Metal Exchange, Swansea.

BRITISH CAST IRON RESEARCH ASSOCIATION.

The Registered Office and Laboratories of the B.C.I.R.A. are at:—

24, ST. PAUL'S SQUARE, BIRMINGHAM.

Telephone: Central 1886. Telegrams: CIRA.

The B.C.I.R.A. Scottish Laboratories are:—

Foundry Technical Institute, Meek's Road, Falkirk (*Telephone 332*).

The Vindication of the Casting.

We had occasion some months ago to mention the relatively favourable position occupied by cast iron compared with wrought materials under the creep test. In fact, some of the very highly-refined and special materials developed in recent years rather resemble a very highly-trained race-horse; very nice to look at, capable of putting up a remarkable performance at intervals, but not so effective as a drayhorse for the rough-and-tumble of regular work under the varying conditions of everyday life.

We now notice that a contemporary has been taking to task an American professor who was urging the use of the elastic limit as a basis for design in engineering practice. Thus it cites a case in which a 60-ton steel, submitted to a certain kind of stress (a fatigue stress) behaves much less satisfactorily than a 30-ton steel. The development of fatigue testing during the past twenty years has been so remarkable that many strength of materials experts regard the ordinary static tests, tensile, compression and transverse, as virtually dead, and there is no doubt that working conditions call much more on the fatigue and vibration-resisting properties than on the straight tensile or compressive strength. It is a singular fact that the stress a material will stand under vibration or fatigue (the endurance limit) is much more closely related to the ultimate tensile strength than to the elastic limit. In fact, it has been established that cast iron, which, in the strict sense of the term, has no elastic limit at all, has a higher ratio of fatigue strength to ultimate strength than some of the steels. Refined methods of testing and the further development of creep tests may, indeed, show that no material has elastic limit in the present sense of the term. Altogether, there is a good deal of experience to suggest that the ordinary untreated materials of construction have much to be said for them, and that attempts to replace them by the more sensitive high-quality and heat-treated materials do not always work out as anticipated. This was demonstrated again and again in the early days of the alloy steels. We would, therefore, urge founders not to take too seriously to heart the lack of an elastic limit or yield point or limit of proportionality and to interest themselves in fatigue and creep tests and see how their material behaves under them. They have everything to gain by it.

It Would Not be Done!

The views expressed in our recent editorial on the subject of the incidence of mechanisation on unemployment have in general been accepted, but there are still a few who cling to the shibboleth that every yard of roller conveyor or a moulding-machine unit displaces man-power and swells the ranks of the workless. Our attention was recently called to a railway cutting, wherein was working a steam navvy, eliminating the donkey-work of literally dozens of men. It was pointed out to us the apparent loss of wages due to its functioning. It was even labelled "a real contribution to the unemployment problem." Yet the cost of the undertaking ran into six figures, but if the contractors had had to submit their estimates on a non-mechanical basis the widening scheme would never have been undertaken. Again, if motor-cars were manufactured on pre-mechanised era methods, there would be less people engaged in the automobile industry than there are now employed in the petrol stations which serve it. So, too, with the foundry. Its mechanisation, when intelligently undertaken, creates work by rendering possible increased purchases because of more attractive prices. Schemes, large and small, are put into operation consequent upon more favourable prices for the materials of construction, whilst the luxuries for the few of yesterday become the commonplace necessities for the million to-day. We feel that it is clearly established that the principle of mechanisation, both incidental and intense, can be justified ethically and statistically as being of real benefit to the greatest number of persons. An outstanding example, if it becomes successful, is the current proposal to construct cast-iron roads. Here, again, unless through mechanisation real cheapness can be assured, it simply will not be done.

F.C.I.R.A.

The Centre de Recherches de Fonderie, established in connection with the great French light-castings vertical trust, has now started to function, just at a time when our own organisation has reached a critical period in its history. It has started off with the advantage of apparently well-equipped laboratories housed in a specially-designed building. The German foundry trade, as is well known, has possessed for some time several well-equipped research institutes, and the character of the work published by them is, like that of the British Cast Iron Research Association, recognised as giving, internationally, the cachés of modernity and reliability to the products of their industries. Obviously, the French have perceived the value of this international advertisement, and do not intend being "left in the lurch." In congratulating the French authorities, we take the opportunity of pointing out to British foundry owners and ironmasters (for it is the French ironmasters who are sponsoring this scheme) the vital importance to their overseas trade of maintaining the ground won by the B.C.I.R.A. in foreign fields of scientific endeavour as applied to the castings industry.

The British Cast Iron Research Association.

VI.—ADVANTAGES OF ITS WORK TO THE INDUSTRY AS A WHOLE.

The work carried out by the Association benefits the industry as a whole, and while the membership of eligible founders is sought on a strictly business basis, there is added satisfaction in the knowledge that contributions advance the standing of the industry as a whole. The Council of the Association has always taken a broad view of its responsibilities, and the following points serve to illustrate the way in which the industry in general benefits from the work of the Association.

(1) During the past four years a score of Papers, scientific and practical, have been presented by officers of the Association to the metallurgical and engineering institutions, thus passing a good proportion of its work into the permanent literature of the subject. The legitimate interests of this country and of members are cared for by a systematic patent policy, and the Papers deal on the whole with broad general principles. They do not refer to details of manufacturing processes or to particular types of manufacture. Several of these Papers have been presented to international congresses of founders and in this way the status of the industry in this country is upheld. Participation in such meetings also is beneficial in its reactions on British export trade.

(2) The Association has issued two reports embodying approved methods of sampling and testing foundry raw materials and products, to preclude difficulties between buyer and seller. These have been made available to all at a small charge. Both are now out of print and are being re-issued in enlarged form. Apparatus designed by the Association for regular daily control of moulding sands is also available to all interested.

(3) The Association co-operates freely in the issue of standard national specifications, and undertook much experimental work on which B.E.S.A. Specifications 309, 310 and 321 were based. These are the first general specifications issued in this country for grey, white-heart and black-heart malleable cast iron.

(4) The Association's Library and Information Bureau, fully dealt with in a previous issue, receives matter relating to founding from all parts of the world, and this is regularly abstracted in a quarterly Bulletin, which is available at a small annual charge to all interested and which is sent to all public libraries, universities and technical libraries.

(5) The Association represents the industry in various capacities on some thirty official committees, and acts in the technical interest of the industry as a whole.

(6) The Association enjoys a high reputation abroad as a national body, and constantly receives visitors and deals with inquiries in a way not possible through any other channel.

(7) The laboratories of the Association (which were acquired in 1926) have become recognised as laboratories in which tests of the highest order of accuracy and reliability can be obtained.

(8) The Association co-operates with the Institute of British Foundrymen and other bodies in the industry, and with the Board of Education in the establishment of education schemes for both craftsmen and executives in the industry. The Association has, therefore, co-operated in establishing a scheme for craft certificates operated by the Institute of British Foundrymen, in conjunction with the City and Guilds of London Institute, and for national certificates conducted by the Institution of Mechanical Engineers. This is done because of the view taken by the Association that the fullest application of research in industry can only be undertaken by a trained personnel.

International Foundry Exhibition and Congress, Milan.

In order to provide facilities for British founders and their ladies to visit the Italian Exhibition, the Institute of British Foundrymen, in conjunction with Messrs. Thos. Cook & Son, Limited, has made arrangements for a party to travel to Italy together, and has also made hotel arrangements in Milan. Members of the Institute of British Foundrymen and the British Cast Iron Research Association and their ladies are invited to take part in this tour.

The arrangements for travelling are as follow:—

Thursday, September 10.—Depart from London, Victoria, 4 p.m. Travel by Bâle and St. Gothard to Milan.

Friday, September 11.—Arrive at Milan, 1.50 p.m.

The Conference will open on Saturday, September 12, continuing until Wednesday, September 16, and the return times are as follow:—

Thursday, September 17.—Depart from Milan, 3.25 p.m.

Friday, September 18.—Arrive at London, 3.20 p.m.

The cost of the return journey, London to Milan, is from £14 16s. per person, upwards, according to the grade of hotel chosen. Arrangements may be made for return *via* Paris at a slightly increased charge.

Visitors desiring to take part in the very attractive tours in Italy which have been arranged by the organisers of the Congress will leave Milan on the afternoon of Wednesday, September 16. Fares for these tours, which are exceedingly attractive, are contained in the official programme, which may be obtained from the General Secretary of the Institute of British Foundrymen.

The costs throughout have been founded on the basis of a party journeying together on the outward journey, and it is desirable that, as far as possible, delegates from Great Britain should do so on the outward journey on Thursday, September 10. The various tours arranged on the conclusion of the Congress allow a wide choice, and any other tour not provided in the programme can be arranged to suit individual requirements, and an inclusive quotation will be given.

This Conference and Exhibition will be one of the most interesting international foundry gatherings which has been held. The Italian foundrymen have obtained for their guests facilities which are not usually accorded to visitors, and the Conference, together with the arrangements made by the Institute of British Foundrymen, afford a unique opportunity of inspecting the most up-to-date works in Italy and of visiting many of the places in that country which are attractive to the tourist. Very full arrangements have been made for the entertainment of ladies during the periods at which the delegates are visiting works and the Exhibition.

All who are interested and who have not already communicated with the organisers are asked to communicate immediately either with Mr. T. Makemson, General Secretary, The Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, or with Messrs. Thos. Cook & Son, Limited, 77, Market Street, Manchester.

It is essential that early application should be made in order that the arrangements may be as complete as possible and that the members of the party may enjoy the maximum comfort.

Random Shots.

A new foundry story, alleged to be true, is being told of the foreman of a small Lancashire jobbing foundry. The firm had secured an order for a number of uniform iron castings, at a price which left little margin for profit and none for wasters. The customer demanded expeditious delivery in no uncertain terms, and, as the foundry has yet to install its first moulding machine, the foreman was vastly puzzled how to comply with the request.

He arrived at a solution by setting all of his moulders on the job, and announced that to the man who made the greatest number of perfect moulds he would award a prize to the value of one guinea. Well, the rate of production of moulds was quite astonishing, and each mould, before being closed, was examined scrupulously by the foreman. The required number of moulds being assembled on the floor for casting, he asked who had made the largest number. Jimmy had.

"Well done, Jimmy," said the foreman. "Here's a shilling. Get yourself a box of Beecham's pills—they're worth a guinea."

* * *

"Marksman" listened with much pleasure on Tuesday evening to the programme of music broadcast by the Stanton Ironworks Silver Band. Their performance delighted his receptive, if untutored, ear, and prompts him to ask, like Oliver Twist, for more. If this was the Band's début on the ether, it deserves to be heard frequently. Long may it play from G to C (or whatever it is that euphoniums and French horns do).

* * *

Quite a number of bands recruited from the iron and steel industry are to be heard *via* the loudspeaker nowadays. The prize band of the Foden Engineering Works has, of course, long been a favourite with admirers of the sounding brass, and another body of players, Blackburn's Steelworks (Preston) Brass Band, also broadcasts this week.

* * *

The special prize of 50,000 francs in the competition organised by the International Bureau of Aluminium was withheld because the judges were of opinion that no entry was of sufficient merit to justify the award. The fond inventors whose efforts were deemed not worthy of the 50,000 francs may feel rather peeved about this decision. "Marksman" himself prepared a sheaf of rough sketches designed to expand the use of aluminium in industry, but, as is not unusually the case, failed to submit these ideas, thereby undoubtedly saving both his and the judges' time.

* * *

One of his little suggestions—"the first fine careless rapture," in fact—related to bowler hats. Bowler hats have, so to speak, been filled to the brim recently with adverse criticism. The journalistic Bohemian writes of them as the insignia of the seemingly staid and respectable; the dress reformer flaunts his kirtle before the eyes beneath them; and Mr. Joad, on Sunday, publicly described them as "little black boxes."

* * *

All this of the old-fashioned felt bowler hat. But imagine a bowler hat of aluminium, its duck's-back surface given a black matt finish, guaranteed not to fade. One could wear it at a positively jaunty angle. Unfortunately, however, from the aluminium-founder's point of view, these hats would be extremely difficult to cast soundly, and porous metal would mean wet heads. They would have to be either pressed or spun. And pressed or spun they will be before next Derby Day. Mark my words!

Marksman.

Sand Testing.

COAL DUST AND THE REFRACTORINESS OF SAND.

Dr. Skerl's Paper* before the Annual Convention of the Institute of British Foundrymen brought out some interesting views on modern sand practice.

The discussion was opened by Mr. B. Hird, who referred to the comment in the Paper on the refractoriness of sand, viz., ". . . pressure reduces the refractoriness of all materials, and impurities in the facing sand from the floor sand, such as coal dust, ash, slag, etc., all reduce the fusion temperature of the facing, which will be lower than that of the new sand." He did not think this was so in the case of coal dust added to moulding sand. When a mould was cast, the volatile matter given off from the particles of coal percolated through the sand and round the grains, and if the grains of sand were examined after the mould had been cast, it would be found that round each grain there was a coating of carbon or carbonaceous matter. He had proved that in a number of experiments he had carried out, and the result was that this sand grain was much more refractory than the ordinary silica-sand grain without the coating. Therefore he was definitely of the opinion that coal dust mixed with sand made the sand more, and not less, refractory.

Reducing Atmosphere induced by Coal Dust.

Dr. Skerl, in reply, said it was a fact that coal dust formed a reducing atmosphere which would tend to reduce any of the fluxing iron oxides in the sand. The matter was of such great importance to people engaged on coal research for industrial purposes that they had decided that, if they did any testing of the ash of the coal or coke dust, it was done under reducing conditions. The conditions in a mould were definitely reducing because an analysis of the gases showed that a great proportion of them were reducing gases, such as CO and hydrogen. These had come, in the main, from the coal dust, and he did not think there was any doubt whatsoever that they reduced the refractoriness of the sand. His own experimental data, and also those which he had obtained from other workers, showed quite definitely that the refractoriness was lowered by coal dust. Another point was that if the coal dust was burnt far enough there was nothing left but ash, and this had a much lower refractoriness than other materials in the sand. The ash fused at about 1,280 deg. C., which was lower than that of the sand and bonding material. The deposit of carbon was not directly at the face of the mould. At the face of the mould near the casting the material was slagged; there was no blackness. It was a white material, which was slag, the constitution of which showed it to be produced under reducing conditions. Behind the face there was a deposit of carbonaceous material which could only be formed under reducing conditions, and all the evidence went to show that coal dust reduces the temperature of fusion of the sand.

Experimental Data on Refractoriness.

Mr. F. Hudson said that in some experiments that had been carried out in his laboratory it had also been more or less found that the presence of carbonaceous matter, such as coal dust, definitely tended to increase the refractoriness of moulding sand. One experiment that was carried out was to take Erith loam sand in the form of a core 2 in. long by ¾ in. dia., to dry it well and place it in an electric combustion furnace at a temperature of 1,250 deg. C. for half an hour. When this was taken out of the furnace it was found that the core had fritted and sintered and was more in the nature of firebrick. A similar sand, but containing 5 per cent. coal dust, was then tested in the same way, and when it was taken out of the furnace the material was in the same condition as when it was put in. It was probably more friable and there was no evidence of any fritting or sintering. With regard to the milling of sand, he took strong exception to the statement by the author that "consistent results cannot be obtained on an unmilled sand," because this statement could easily be misinterpreted, when coming from such a recognised authority as the author, to mean that consistent results can only be obtained by the use of a mill. No doubt the author would agree that there was other sand-preparing equipment available which would give equal, if not more consistent, results as compared with the mill.

Constitution of Sand.

Then there was the question of the mechanical constitution of moulding sand. The author favoured the elutriation process, but the speaker's own view was that mechanical analysis, with varying degrees of accuracy, could be carried out by sieving methods. By using the A.F.A. standard methods for testing sands, the percentage of clay obtained by a combined sieving and sedimentation test on Erith loam sand was 14 per cent. against 14.1 per cent. by elutriation, and that was a very good degree of accuracy. Another point was the relation between strength tests and permeability results. These, for practical purposes, and in order to obtain the full benefit of sand testing in the foundry, should be comparable, and should be carried out on the same sand under the same conditions. In Table II, however, the strength tests in the case of Kingswinford sand were in relation to ramming densities of 1.8 and 2.0, whereas the same sand in the permeability results related to a ramming density of 1.5. The author had shown in the Paper the enormous effect of ramming densities, but in this case there was no actual comparison between the strength test and the permeability result. If the ramming density was taken at 1.5, the permeability was about 135 secs., but with a ramming density of 1.8, the permeability result would be 220 secs. Therefore it would be a great advantage to the industry as a whole to have the tests on a comparable basis. In Table VI, relating to refractoriness, the author gave no indication of the time the specimens were heated. He was sure the author would appreciate that this was an important factor, and it would be interesting to know what the time was. In conclusion No. 10, with regard to permeability and moisture percentage, the author suggested there was no relation. Personally, however, he felt that the evidence previously given in the Paper showed there was a definite relation.

Practical and Research Aspects.

In conclusion, Mr. Hudson said the author was to be congratulated on the manner he had presented the Paper to the Institute. To-day, there was a greater need than ever for international co-operation and exchange of views, and the British foundry industry would benefit enormously if the excellent results obtained from sand investigations were on a common basis. By far the greatest amount of research work on sand had been conducted by the American Foundrymen's Association, and it would be a loss if all the valuable data so far obtained could not be directed into useful channels. It was necessary that the apparatus adopted for the testing of sands in this country should yield results comparable with those obtained in other parts of the world. Furthermore, he felt that the chief desiderata of sand-testing methods should, in the first place, yield results of full control value to the foundry industry from the practical point of view and take second place under research conditions, a view which was, perhaps, opposite to that expressed by the author.

Advantages of Elutriation.

The Author said that although Mr. Hudson had carried out some tests in an electric furnace on core sands, they were under laboratory conditions and not under conditions found in a mould where, as he had pointed out in reply to a previous speaker, the atmosphere was definitely reducing. Therefore, it would not be wise to attempt to draw too many conclusions from such results. The point which it was wished to make in the Paper about milling sands was that it is impossible to get consistent results by mixing sand by hand. It was necessary to have some mixing device, and the mixing device which was most efficient was, in his opinion, the mill. He was referring, however, to the natural moulding sands and for these he knew of nothing better than the mill. The American method mentioned by Mr. Hudson was not a sieving process but a sieving and sedimentation process. Sedimentation was based on the same theories as elutriation and therefore one would expect to get similar results. He had been carrying out work, for many years, with both methods, and had found elutriation the better, partly because it eradicated any personal element and also because it allowed one to do other jobs whilst the process was proceeding. He did not think sieving was sufficiently accurate, especially for the important fine particles of the sand, and he preferred elutriation. As to the strength and permeability results, it was quite possible to put the results down as had been suggested because all the information was available, but he did not think that would have been wise for the reason that the strength of the sand had been given at a high ramming figure to give a better idea of the variations available in different types of new sand. At the ramming density mentioned for the permeability results, however, he was definitely within the range of practical politics and he had put those figures in for the guidance of those who were more concerned with permeability than strength. All the figures were available, however, and perhaps he should have put in the figures of the different ramming densities. At the same time, the Paper was not meant to be a complete scientific dissertation; it was meant to give, in as popular terms as possible, the results of some research work and the full information was available for those members of the Cast Iron Research Association who required it.

Moisture Content and Permeability.

With regard to refractoriness, he gathered Mr. Hudson was referring to the fusion point of the sand tests. Those tests were carried out in a muffle furnace in which the temperature was increased at the rate of 50 deg. in 10 min. It was a gas-fired furnace.

Mr. Hudson: What was the total time of heating?

The Author: The temperature was increased until the material collapsed; the fusion point.

Continuing, the author said that was the case in the tests in the Paper referred to. The statement that there was no definite relationship between permeability and moisture content was a definite statement, and there was no evidence in the Paper from which a contrary conclusion could be drawn, although Mr. Hudson suggested there was. The evidence of that nature which Mr. Hudson probably had in mind was the statement earlier in the Paper: "It has not been found possible to state any definite conclusion regarding the moisture content at which all sands are most permeable, but it may be said that for most moulding sands the permeability is

(*Concluded on page* 98.)

* Foundry Trade Journal, July 23 and August 6, 1931.

Some Notes on the Law Affecting the Sale of Goods.

By a Barrister-at-Law.

The General Rule.

It is no doubt a matter almost of common knowledge that in a sale of goods there is, generally speaking, no implied condition or warranty as to the quality of those goods, or of their fitness for any particular purpose, the maxim *caveat emptor* being applied. But it is not so well known that there are certain exceptions to this general rule. At any rate, the precise nature of such exceptions is seldom understood by the average business man. The more important of these exceptions are worth mentioning.

Implied Condition as to Fitness.

When there is a contract for the sale of goods by description, there is an implied condition that the goods shall correspond with the description. In case the buyer expressly, or by implication, makes known to the seller the particular purpose for which the goods are required, so as to show that he relies on the seller's skill or judgment, and the goods are of a description which it is the course of the seller's business to supply, there is an implied condition that the goods shall be reasonably fit for such purpose. But if the contract is for the sale of a specified article under its patent or other trade name, there is no implied condition as to its fitness for any particular purposes.

Defects Not Apparent on Examination.

Should goods be bought by description from a seller who deals in goods of that description, there is an implied condition that they shall be of merchantable quality, subject to this, that if the buyer has examined the goods, there is no implied condition as regards defects which such examination ought to have revealed. If goods are sold by sample, there are implied conditions that the bulk shall correspond with the sample in quality, that the buyer shall have a reasonable opportunity of comparing the bulk with the sample, and that the goods shall be free from any defect rendering them unmerchantable which would not be apparent on reasonable examination of the sample.

Goods Bearing Trade-Marks.

When an article is sold with a trade-mark, label, ticket, etc., thereon, or any statement thereon of the weight, quantity or quality thereof, a warranty is implied that the trade-mark, label or ticket, etc., is genuine and true, and that any such statement is not in any material respect false, unless the contrary is expressed in writing, signed by or on behalf of the seller, and delivered to and accepted by the buyer. It should be added that if a fact is known to a buyer at the time of the sale, or might have been known to him—something, for instance, with an obvious defect which could be easily seen—a warranty will not protect him. If an article is sold expressly "with all faults," the only case of defect for which the purchaser could sue the vendor would be where the latter had used artifice to prevent the purchaser from discovering it. It would not be sufficient simply to show that the vendor knew of the defect.

Custom and Business Transactions.

It should be observed that cases may arise in which conditions usually implied may be negatived by express agreement or impliedly waived. Express terms, for instance, when inconsistent with the existence of conditions usually implied, defeat the implication. Moreover, custom, also, may negative a condition usually implied, or may have the effect of attaching an implied condition or warranty. It may be desirable here that a word should be said upon the important effect of custom when it applies. The rules of the negotiability of bills of exchange, it may be remarked, arose out of the custom of merchants, which assumed that the making of a bill or note was a business transaction. In connection with this, the special character of a bill of lading will not be overlooked, although the limits of a short article only allow of a passing reference to the subject.

Bills of Lading and Insolvency of Consignee.

A bill of lading is termed "a document of title," because it is a receipt by the master of a ship for goods entrusted to his custody for delivery to a particular person, or his assigns. Three copies are made of this receipt, each signed by the master, one copy being kept by the consignor of the goods, one by the master of the ship and one being forwarded to the consignee. The last named, on receipt of it, acquires a property in the goods which can only be defeated by the exercise of the vendor's equitable right of stoppage *in transitu*. But supposing, as often happens, that a consignee assigns a bill of lading by indorsement to a holder for value, then that holder has a better right than the consignee had. He thereby obtains a title to the goods which overrides the vendor's right of stoppage *in transitu*, and can claim them notwithstanding the insolvency of the consignee and the consequent loss of the price of his goods by the consignor. In this respect, however, he has a right of property only; based, of course, upon the custom of merchants, or what is termed the "Law Merchant." But while the assignment of the bill of lading gave a right to the goods, it did not at Common Law give any right to sue on the contract contained in the bill of lading. This right was conferred by statute, and now the assignment of a bill of lading thereby transfers to the assignee not only the property in the particular goods but also "all rights of suit" and "all liabilities in respect of the goods, as if the contract contained in the bill of lading had been made with himself." The different aspects of negotiability between a bill of lading or a bill of exchange need not be discussed for present purposes.

Goods Carried by Land or Water.

Under the Sale of Goods Act, goods are deemed to be in course of transit from the time when they are delivered to a carrier by land or water, or other bailee, for the purpose of transmission to the buyer, until the buyer, or his agent in that behalf, takes delivery of them from such carrier or other bailee. If the buyer, or his agent in that behalf, obtains delivery of the goods before their arrival at the appointed destination, the transit is at an end. After the arrival of the goods at the appointed destination, if the carrier or other bailee acknowledges to the buyer or his agent that he holds the goods on his behalf, and continues in possession of them as bailee for the buyer or his agent, the transit is at an end, and it is immaterial that a further destination for the goods may have been indicated by the buyer.

Rejected Goods.

In case the goods are rejected by the buyer, and the carrier or other bailee continues in possession of them, the transit is not deemed to be at an end, even if the seller has refused to receive them back. Where goods are delivered to a ship chartered by the buyer, it is a question depending on the circumstances of the particular case whether they are in the possession of the master, as a carrier, or as an agent to the buyer. But whether when notice of stoppage *in transitu* is given to a shipowner there is any duty imposed on him to communicate the notice to the master of the ship, and whether such notice is effectual until thus communicated, must be considered doubtful, according to certain authorities.

Delivery Refused.

In case the carrier, or other bailee, wrongfully refuses to deliver the goods to the buyer, or his agent in that behalf, the transit is deemed to be at an end. Where there has been part delivery of the goods to the buyer, or his agent in that behalf, the remainder of the goods may be stopped *in transitu*, unless such part delivery has been made under such circumstances as to show an agreement to give up possession of the whole of the goods.

Effecting Stoppage *in transitu*.

In order that the seller of goods may exercise the right of stoppage *in transitu*, it is not essential that he should actually seize the goods, for the stoppage may be effected by giving a notice to the carrier or other forwarding agent. When a servant of the carrier is conveying the goods, notice may be given to the servant or the principal. But if notice is given to the latter, it must be given in time to enable him to inform the servant before he delivers the goods.

Sand Testing.

(*Concluded from page* 97.)

greatest at approximately the moisture content at which the sand is strongest in the green-sand condition . . ." That was quite right. There was no relationship between the permeability and the moisture content. It was impossible to lay down the law definitely.

Mr. Hudson: If one takes a sand with 5 per cent. moisture and increases it to 10 per cent., one sees a definite increase in the permeability figure.

The Author: No; one may find a decrease.

Prizes of International Aluminium Competition Awarded.

At the beginning of this year the European producers of aluminium organised a competition, details of which were given in these columns, in which prizes were offered for suggestions designed to develop the use of aluminium and its alloys. The committee of judges has now finished the examination of the entries, and the following prizes have been awarded:—

(1) A prize of 25,000 French francs, awarded to Mr. Constantin Szmukler, 1, Rue Chaper, Grenoble (Isere), France, for a contribution on the use of aluminium in leather dressing and tanning.

(2) A second prize of 25,000 French francs has been divided equally between Dr. H. Hampel, Elsasserstrasse 15, Pojeduch, near Stettin, Germany, and Mr. de Haes, 3, Rue de Veeweyde, Bruxelles-Midi, Belgium, for two entries relating to the use of aluminium in radiators for central-heating systems.

(3) The special prize of 50,000 francs has not been awarded, the judges being of the opinion that no suggestion made was of sufficient importance and exceptional novelty to justify this award.

The competition undoubtedly aroused great interest in technical circles in the majority of countries. Approximately 1,000 persons approached the International Aluminium Bureau for information on the competition, and eventually 291 entries were submitted to the judges. For the most part these entries were highly meritorious and showed careful study of the properties of the light metals.

The New Montreal Foundry of the Canadian National Railway Company.

The grey-iron foundry at the Point St. Charles (Montreal) shops of the Canadian National Railways is the fourth unit to be completed under a rehabilitation and modernisation programme, whereby all the old repair plants at that place, comprising locomotive and carriage shops, grey-iron foundry, stores, etc., will be replaced by completely modern facilities. The stores building, the first unit to be completed, has been in use about four years. The new power plant, which replaced the two old power-houses, and was the second unit completed, was placed in service late in 1928. The third unit, comprising the locomotive shop, was placed in complete operation in July, 1929.

The foundry, patternshop and pattern storage, are located in one building which has a ground-floor area of 265 ft. by 165 ft. The foundry is 205 ft. by 165 ft.; the patternshop, which is located at the south end of the building, is 60 ft. by 165 ft. The two floors for pattern storage are located over the patternshop and are of the same area, 60 ft. by 165 ft.

The foundry building (Figs. 1 and 2) consists of three bays, the east and west bay each being 50 ft. wide, and the centre bay 65 ft. wide; their length is 205 ft. and the clearance height from the floor to the bottom chord of the roof truss is 40 ft. The west bay is served by a charging crane, the centre bay by two electric overhead travelling cranes, one of 15 tons and one of 5 tons capacity, and the east bay by one 5-ton electric overhead travelling crane. Other lifting facilities are provided by four jib cranes equipped with electric hoists, and a pouring monorail which extends along the east wall of the foundry floor is of reinforced concrete with smooth metalled surface except in the cleaning area, where a mastic surface is applied.

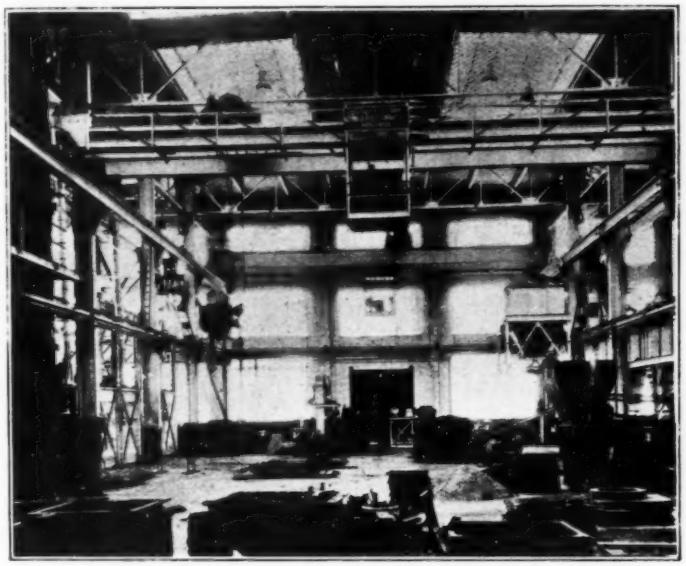


Fig. 1.—The Centre Bay of the New Foundry, Canadian National Railways, Point St. Charles, Montreal.

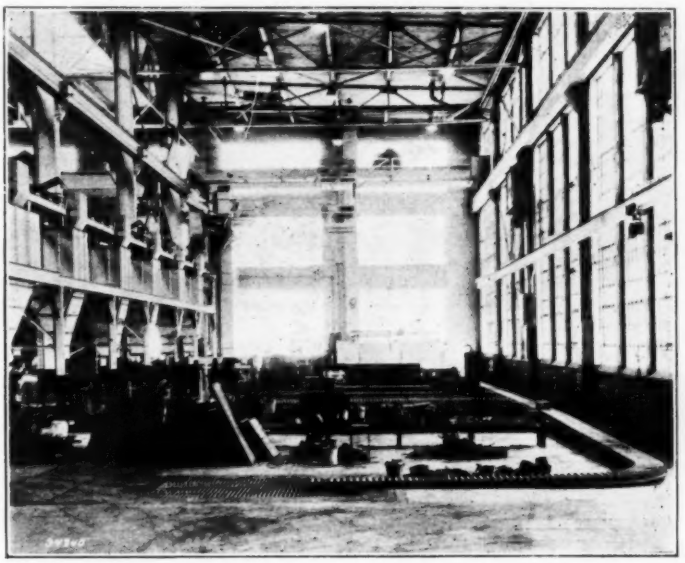


Fig. 2.—A View of the East Bay, looking North.

Raw-Material Storage.

The west bay (Fig. 3) is largely taken up by bins for the storage of coke, pig-iron, scrap cast iron, scrap steel, limestone, clay and moulding sand. The storage of these materials inside the building is a distinct advantage, especially in winter, such work as the thawing-out of truck-loads of frozen sand being thereby eliminated. The charging crane is used to transfer the materials from the railway trucks to the bins (Fig. 4), the metals being handled with a magnet, and other materials by a single-line clam-shell bucket. The crane is a 5-motor one, equipped with a 5-ton standard hoist and a 3-ton charging hoist. The bins for all materials other than sand are constructed so that their contents gravitate to a rake-out platform along their front.

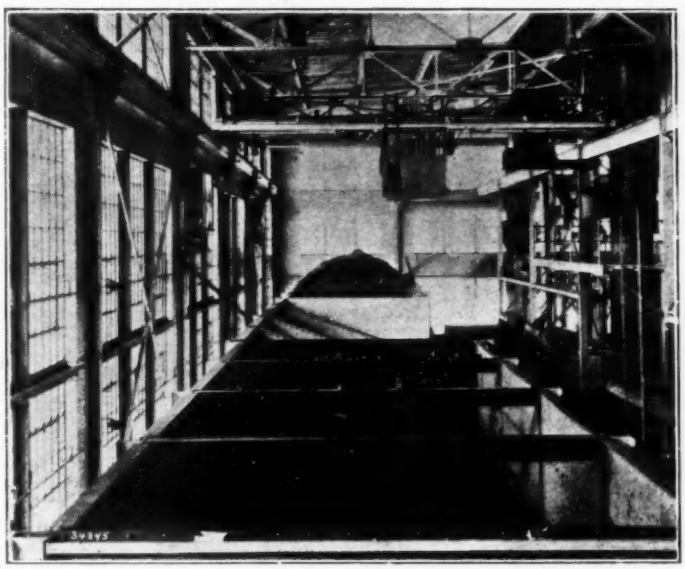


Fig. 3.—The Raw-Materials Storage Bins in the West Bay.

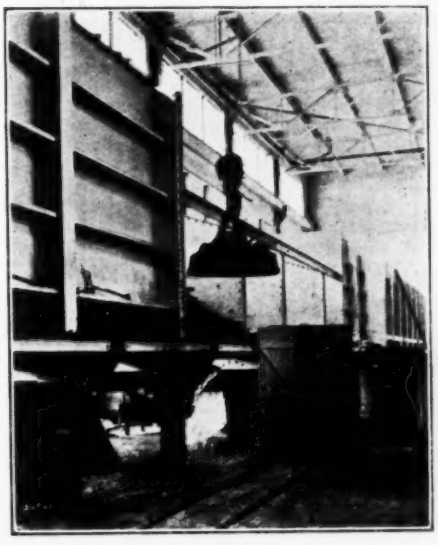


Fig. 4.—Front of the Storage Bins, showing the Rake-out Platform and Charging Scale.

Underneath the lip of the rake-out platform is a 6-beam charging scale, which travels the full length of the platform on a 30-in. industrial track. The charging buckets are placed on the scale and can be loaded from the rake-out with a minimum amount of labour; they are then set aside on roller conveyors to be picked up by the

D

charging crane. The sand bins are equipped with discharging gates in the bottom, from which the sand is drawn off into skid hoppers, which are handled by motor-operated lift trucks.

Melting Plant.

The cupolas, shown in Fig. 5, are each 72 in. in dia. by 70 ft. high, one being brick-lined to 54 in. in dia, and the other to 42 in. They are both equipped with wish-bones in the charging opening, and cone-bottom buckets are exclusively used for charging. The centrifugal blower has a maximum capacity of 6,200 cub. ft. of air per min. when working at 3,500 r.p.m. and a maximum pressure of 24 ozs. The air intake is outside the building, with a duct under the floor to the fan suction. The motor and electrical equipment is totally enclosed; the blower equipment is not housed separately. The rated capacity of each cupola is from 6 to 7 tons an hour.

All the heavy castings are poured in the centre bay. The other equipment in this bay includes the dry-sand conditioning plant, the green-sand conditioning plant, the sandslinger, etc. The core ovens (Fig. 6), which are electrically heated and equipped with automatic control, are in four sections, each 10½ ft. wide by 17 ft. deep by 9¾ ft. high. In each section there are two cars, running on standard-gauge track, which are fitted with sectional steel racks designed so that they can be lifted in sections as required by the overhead cranes.

Sand Handling.

The green-sand handling equipment is a very complete unit. There are three shake-out hoppers, one in the east bay and two in the centre bay, located below floor level and covered by substantial gratings. The used sand is delivered by apron conveyors to a belt conveyor beneath the floor level, which delivers it to the conditioning plant at the north end of the centre bay. There it is freed from core irons, nails, etc., screened, reduced to the correct consistency, revivified and finally elevated to an overhead belt conveyor which runs along the west side of the bay. From this overhead belt conveyor the reconditioned sand is ploughed off as required into a series of hoppers, one of which feeds the sandslinger (Fig. 7), six others being located with their discharge gates directly over the moulding machines which serve the east bay, and the eighth taking the spill over at the end of the conveyor, whence the sand can be taken by skid hopper and lift truck to various points for ordinary floor moulding.

The dry-sand work is concentrated as far as possible in the north-west corner of the centre bay, near the ovens, and for this reason dry-sand conditioning plant does not require such a conveyor system as the green-sand plant. The reconditioning of the sand is just as complete, but as only one shake-out and one delivery point are required, it was possible to concentrate the apparatus within a very small area. The sand-slinger travels nearly the whole length of the east side of the centre bay on a 36-in. gauge track; it carries 12 tons of sand and is operated by push-button controls on the operating head.

Fig. 5.—The Cupolas and Centrifugal Blower.

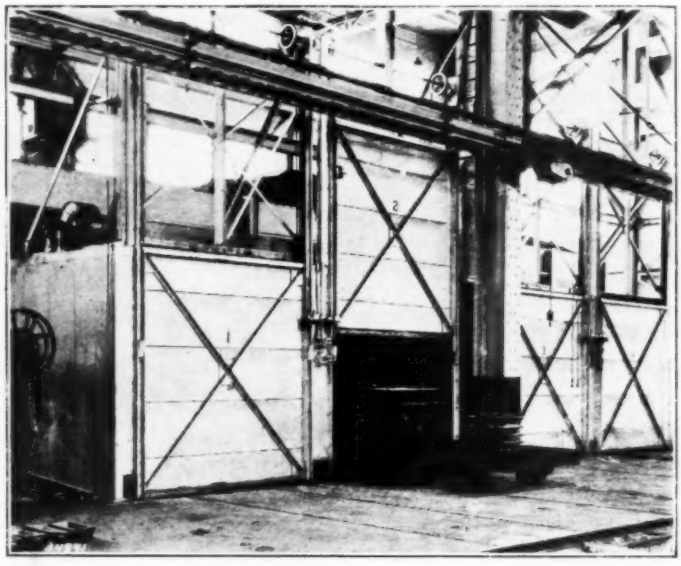


Fig. 6.—The Mould and Core Ovens.

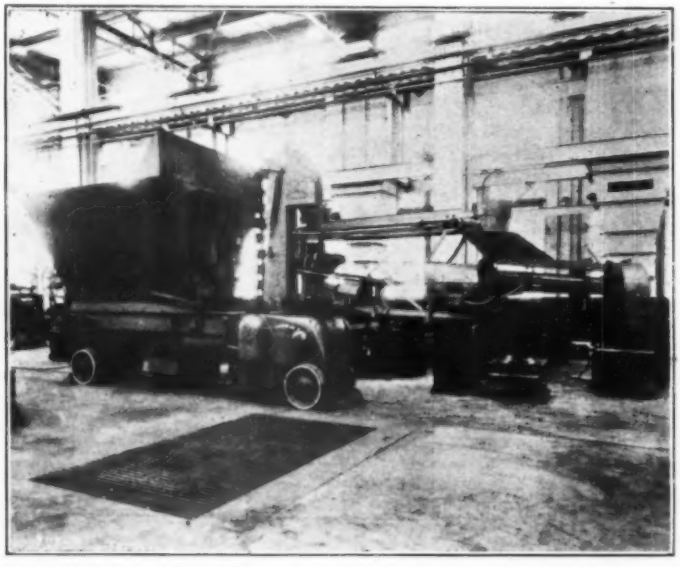


Fig. 7.—The Sandslinger and Moulding Machines.

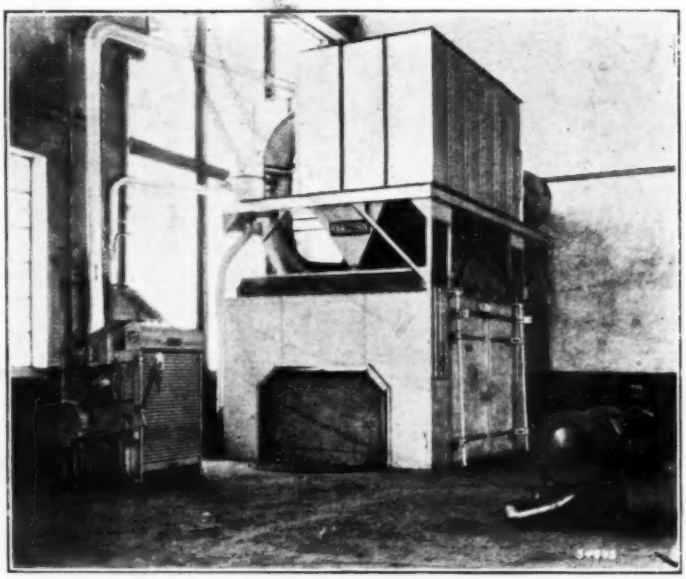


Fig. 8.—The Sand-Blast Room.

Pouring and Cleaning Methods.

Along the west side of the east bay, where the lighter green-sand castings are poured, are six moulding machines, and the hoppers for the storage of prepared sand, which are located directly over the machines. As the moulds are made they are set aside on roller conveyors lead-

ing directly across the bay to the pouring line. The pouring mono-rail extends along the east wall of the bay; all pouring is done on the roller conveyor directly beneath it. The iron is brought from the cupola in lift-truck ladles, and, as the pouring is done, the flasks gravitate to the shake-out. At the far end of the bay is a battery of three electrically-heated core ovens, in which all the smaller cores are baked. The shake-out in the east bay is located very conveniently next to the cleaning area. The sand-blast room (Fig. 8) is 15 ft. by 12½ ft. by 9 ft. high, inside dimensions, and admits a 10-ton car on standard-gauge track for handling heavy castings; a turntable, 8 ft. in dia., is also provided in one side of the room for handling castings of moderate weight. The sand-blast barrel installation has a rotating drum 2½ ft. in dia. by 3 ft. 4in. long, and all the small castings are cleaned in it. Angular steel grit is used entirely in the sand-blast nozzles of all cleaning apparatus.

The ventilation of the foundry is taken care of by seven 84-in. and twelve 18-in. ventilators in the roof of the centre bay, seven 48-in. ventilators in the roof of the east bay and four 48-in. and two 60-in. ventilators in the roof of the west bay. The heating system consists of 8-unit heaters, located on the outside walls, and arranged so that the air supply can be taken from the outside or the inside of the building as desired. Eleven unit heaters of smaller capacity are used to heat the pattern shop and pattern-storage floors.

The building is of the same type of construction as the locomotive shop, the outside walls being of concrete to the first row of windows, 5 ft. above floor level. From that point up, the walls are of red brick, with reinforced concrete bands above each row of steel window sash. All roof drainage is carried down inside the building to storm sewers.

The plans for the foundry were prepared, and details designed by and erected, under the supervision of the Canadian National engineering and mechanical staff, under the direction of Mr. S. J. Hungerford, vice-president, operation and construction departments; Mr. C. B. Brown, chief engineer, operation department; Mr. W. A. Duff, engineer of standards; Mr. C. E. Brooks, chief of motive power, and Mr. J. Roberts, general supervisor of shop methods.

We acknowledge with gratitude the assistance in the preparation of this description given to us by the London Press Bureau of the Canadian National Railways.

Fig. 9.—The Pattern Shop.

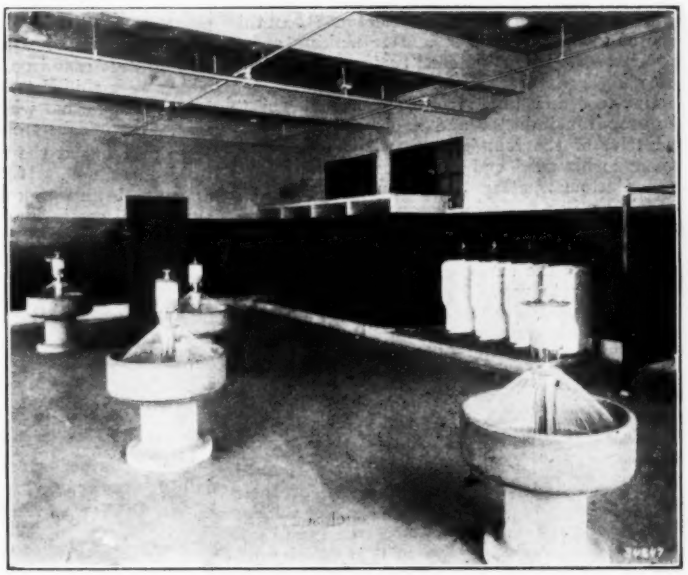


Fig. 10.—The Washing Rooms.

Pattern Shop.

The pattern shop, which is illustrated in Fig. 9, is separated from the foundry by a hollow tile wall and fireproof doors; it is equipped with a sprinkler system for fire protection, and the same protection is extended to the two pattern-storage floors located above the shop. The pattern-storage floors are reached by a stairway and are also served by a 5-ton freight elevator operated by automatic push-button control. The mechanical equipment includes a universal wood miller, a cross-cutting and trenching machine and a complement of lathes, circular saws, band saws, sanders, etc. The shop is equipped with the usual shaving-exhaust system, and the floor is made with creosoted wood blocks.

The washing rooms, illustrated in Fig. 10, on the second floor over the pattern shop, are equipped with adequate lavatory facilities, wash fountains, showers and metal clothes-lockers. There are also drinking fountains and conveniences at suitable locations on the ground floor of the building.

Decoration, Heating, Lighting and Ventilation.

The interior painting of the building follows the same general scheme as was used in the locomotive shop. The entire interior of solid walls and roof, together with all steel superstructure, is coated with aluminium paint down to within 5 ft. of the floor level; the remaining 5 ft. is finished in black. This greatly assists in the uniform diffusion of light throughout the shop.

Iron and Steel Production.

The National Federation of Iron and Steel Manufacturers, in their Statistical Bulletin for June, report that production of pig-iron and steel continues to show a slight decline, for although steel production only declined from 435,100 tons in May to 428,900 tons in June, the May production was affected by the Whitsun holidays, and the decline is therefore rather greater than the figures indicate. The output of pig-iron declined from 346,500 tons in May to 323,800 tons in June, a decline of 3 per cent. in the rate of production when allowance is made for the day less in June. Since the number of furnaces in blast declined by four during July, production will probably show a still further decline.

Catalogue Received.

Electric Furnaces and Ovens.—We have received from the General Electric Company, Limited, Magnet House, Kingsway, London, W.C.2, a well-illustrated 16-page brochure which describes in non-technical language an extremely wide range of electrically-operated furnaces, which they have designed for industrial needs. We just wonder whether the application of the designation "Magnet" may not be a little misleading, for, after all, magnet has a *technical* meaning. Instead of detailing all the uses to which their designs can be put, it is virtually correct to say "everything," except ferrous-metal melting. For the foundry industry there are described furnaces for melting non-ferrous alloys, and, in this connection, we suggest that the description is just a little too meagre; furnaces for enamelling, mould and core drying, and the heat-treatment of finished castings. These present extremely interesting developments for foundry owners, which should not be judged purely on direct price considerations, because electric heating and atmosphere control are such exact sciences. Thus, elimination of variations in quality of product, with which is associated scrap reduction, is assured. A development, of which the designers of electric furnaces must take cognisance, is continuous operation, to replace batch manufacture. Such a furnace is illustrated on page 7, and we specially commend our readers' attention to the letterpress on that page. It is so thoughtfully prepared that we could only add that, for solid-fuel-fired furnaces of any serious capacity, one has to envisage the construction of a chimney or, as the compiler of this brochure points out, be limited in the choice of site by flue considerations. The list of questions posed on page 16 is excellent, and we think that this method is preferable to the insertion of a tear-out *questionnaire*, as it serves for more than one inquiry. A final suggestion, however, is that one might ask for the inclusion of a statement as to existing methods and their cost, because, after all, local conditions may preclude the adoption of electric heating on the grounds of cost, and early knowledge may prevent much waste labour in the estimating and designing departments.

We understand that this publication is available to our readers on request.

Sawdust and cement mixed in equal parts make a good flooring material.

High-Test and Alloy Irons.*

By L. M. Sherwin and T. F. Kiley.

During the past few years many Papers and much research data have been published on the subject of high-test and alloy cast irons, both in America and abroad. Investigations along these lines have done much, it is thought, to clarify and improve that complex material known as cast iron. The pioneers in the study of these irons and in research and practical work in this connection are to be congratulated for their splendid work, for a few years ago it required the highest type of courage even to consider melting up to 95 per cent. steel in a foundry cupola. At the present time many good foundrymen are still far from being convinced. There are foundries that have benefited in a very practical way by the application of the data brought out in these Papers. Others are engaged in a class of work where there is no practical use for this type of iron. Also, others, after making a few experiments, have abandoned further attempts as being highly impracticable.

High-test and alloy irons are a real aid to the grey-iron industry and well worth the study and trial of the foundryman, who sometimes is driven to his wits' end to produce a sound casting. Customers often have been driven to substituting other material because of the lack of quality in their grey-iron castings. There are many types of grey iron, some only having the qualities that the customer wants and for which he is willing to pay. The time has come when founders must study more carefully the requirements of the customer, give him the quality he desires and educate him to pay a fair price for a superior material. This attitude will do much in bringing the grey-iron industry again into its own.

High Standards Maintained.

The firm with which the authors are associated conduct a foundry for the production of their own machine-tool castings, and also do a large jobbing business. The standards are high, and high standards mean higher costs, so that ordinarily the foundry does not get the simpler work. Very often the work is something some other firm has had trouble with, and high-test and alloy irons have been of invaluable aid in solving some problems that otherwise could have been overcome only with great difficulty and loss. Melting large percentages of steel in the cupola in the production of high-test iron, pouring the product into moulds and obtaining a superior casting for certain classes of work, is a problem which presents many chances to err on some particular phase, with resulting loss. Consequently, very strict attention must be paid to details; an exact procedure must be worked out and carefully followed. The procedure outlined in this Paper is the culmination of a great deal of practical foundry research carried out over a period of three years before this material obtained its present position and gave consistently good castings.

Sound Castings Essential.

It may be stated here that the main interest in high-test cast iron has been in the production of a sound casting. High strength, which generally follows, is in most cases a secondary consideration. For the major portion of the domestic castings and outside work, some one of the regular iron mixtures will produce a satisfactory casting. Frequently, however, a job arrives for an outside customer, or a difficult design for internal work, requiring the use of alloy or high-test iron. These include castings which have been found very difficult to get sound from regular mixtures containing up to 30 per cent. steel, even with low silicon content, without resorting to chills; castings of such design as to favour a draw between thin and adjoining heavy sections; heavy-sectioned castings requiring absolute soundness when machined deeply; castings used in hydraulic work, subject to high pressures, or castings where high strength or exceptional wearing qualities are demanded.

Very obstinate cases of internal shrinkage, sponginess and porosity almost invariably can be eliminated by the use of low-carbon cast iron, and often this offers the only solution unless it is possible to stop the trouble by the use of chills or feeders. Sometimes chills are the cheapest way out, particularly if the casting has sections less than ¼ in., or if the section causing the trouble is easy to chill. Chills, however, are expensive and always present a hazard in the mould, due to their tendency to collect moisture and cause a blow. During the preliminary work on high-test cast iron, many castings were tried which were chilled to get soundness with regular iron mixtures, but which, when tried in high-test iron, invariably were sound without chills.

On arriving at the foundry, patterns are carefully examined. If the design seems to be difficult, before proceeding with the order experimental castings are made up from a mixture considered most suitable, and castings are sawed on a power hacksaw at locations where there is a tendency to have a shrink. If castings are too large to do this, they are sent to the shop and partly machined before proceeding. In this way the accumulation of a large percentage of defectives in the machine shop—a loss both to the foundry and to the customer—is often prevented.

Cupola Practice.

Melting is performed in the same cupola used daily for the regular iron mixtures. This is lined to 54 in., with a tuyere to cross-sectional area of 1 : 5. Air is supplied by a turbine blower delivering 6,500 cub. ft. per min. per gauge at a pressure of 12 to 15 ozs. A high coke bed is carried 60 in. above the top of the tuyeres. The bed is ignited by means of an oil burner through the breast. When the flames start to break through the bed, the oil burner is removed, and the blast is put on for a few minutes until the bed is brought to an incandescent red all over the top. Charging then is started at once. Ton charges and hand charging are used throughout the heat. About 100 lbs. of a good grade of limestone and 6 lbs. of alkali flux are thrown in on the bed. High-test returns then are scattered all over the bed. Half of the steel charge comes next, leaving a depression in the centre for the ferro-alloys. Ferro-alloys then follow, and finally the remainder of the steel, completely covering the ferro-alloys.

As a general rule, not above one to two tons of high-test cast iron are run, and this is always charged first. Three hundred pounds of foundry coke are used between charges. The cupola then is filled to the door with other grades of iron and allowed to stand for one to two hours before putting on the blast. The intense firing of the bed and the preheating aids, it is thought, in preventing a frozen tap hole, and ensures very hot iron from the start. A breast brick, with ¾-in. dia. hole, is used, and the stream is practically continuous on opening the tap hole, except when raising the level of metal for slagging.

Handling the Iron.

The iron runs into a 1,000-lb. receiver ladle, which delivers iron to ladles on a mono-rail, which, in turn, delivers iron to the moulders in the light foundry for shanking, or a receiver ladle delivers to a lift-truck ladle for pouring the heavier work. All ladles are heated up with charcoal fires before pouring iron into them. The tap hole is opened 20 minutes after the blast is put on. The first few hundred pounds of this iron is pigged to warm up the ladles. An extra 1,000 lbs. over requirements of high-test iron is allowed for warming up the ladles and to ensure against getting too close to other grades of iron in the stack.

Table I.—*Materials and Steel-Scrap Specification.*

Materials of Charge.

Materials charged.	Quantity, lb.	Per cent. of total charge.
Steel rails, tyres, or cold-rolled factory steel (none very light nor very heavy)	1,500	75.0
High-test returns	390	19.5
Silico-manganese (lump)	25	1.25
Ferro-silicon (lump)	85	4.25

Steel-Scrap Specification.

Used to following specification:

Carbon	0.60 per cent. max.
Section	¼ in. to 1 in. thickness
Weight	Not to exceed 30 lb.
Length	18 in. max.

No small clippings, punchings or similar stock. Steel must be clean and free from scaly rust.

The mixture following the high-test iron is one containing 30 per cent. of steel. The steel is charged first, so there is very little trouble with getting a higher carbon due to contamination from higher carbon mixtures. Readings taken with an optical pyrometer, shortly after opening the tap hole, show about 1,535 deg. C. Table I gives the data on the materials of the charges when high-test return scrap is available. Table II gives the data on the charges when high-test returns are not available.

Table II.—*Mixture Used when High-Test Returns are not Available.*

Materials charged.	Quantity, lb.	Per cent. of total charge.
Steel	1,500	75.0
Ferro-manganese (lump 80 per cent. Mn).	30	1.5
Ferro-silicon (lump 50 per cent. Si)	70	3.5
High-silicon pig: T.C. 1.39, Si 14.45, Mn 0.15, S 0.16, P 0.12 per cent.	140	7.0
High-manganese pig: T.C. 3.80, Si 2.78, Mn 2.16, S 0.025, P 0.22 per cent.	260	13.0

High-test iron for medium castings is distributed to the moulders rapidly by mono-rail. Hand ladles are well dried and heated with molten iron before using. Iron must be poured just as hot as possible, as the rapid setting nature of this type of iron will not permit dull pouring. Moulders not accustomed to such irons are inclined to allow it to cool off before pouring, with disastrous results. A sufficiently large pouring crew must be used to empty a 300-lb. tram ladle rapidly. Heavier work need not be handled so fast nor poured quite as hot.

Moulding and Gating.

Iron must be poured into moulds for medium work just as rapidly as possible. The gates are, in general, about half as thick again as those ordinarily used with a 20 per cent. steel mixture. Medium castings often are poured "two up" in order to get the iron into the mould fast enough. Basins are kept well choked and risers and strainer gates resorted to, to ensure an absence of slag in the castings. Heavy sections must have ample risers at the high point; with this iron, external liquid shrinkage is greater than with usual grades, and depressions are likely to occur unless fed back. The risers often are fed back with hot iron, but they must be large enough to set later than the casting adjacent to it, otherwise the riser will draw from

* Extracted from a Paper presented before the American Foundrymen's Association. The authors are on the staff of the Brown & Sharpe Manufacturing Company.

the casting, leaving a spongy spot. Moulding, gating and pouring must be of a high grade to ensure success in casting.

Sand Used.

The action of this metal on green-sand moulds for medium and heavy work is very severe, resulting in very rough surfaces, cuts, scabs and washes, which indicates that green sand does not withstand this iron in this class of work. Green sand also results in a large percentage of castings showing slag inclusions and gas-holes after machining. This is probably due to necessary moisture in the green sand, which further hastens the setting of an already fast-setting metal and prevents the elimination of gas and slag from the metal.

After trying various means to overcome this trouble by the use of steel moulding sands, and by blacking heavily the surface of moulds, green sand had to be abandoned in favour of dry-sand moulds on the medium work. The moulds are faced with a fine oil-sand mixture and blacked with an open glutrin-bonded sand. The used sand in glutrin backing sand is taken from crushed dry-sand moulds after shaking out. Dry-sand moulds for medium work are baked overnight at a temperature of 210 deg. C.

Lacking facilities for baking the moulds for heavier work, a flour-bonded facing sand generally is used with a backing of green sand from the sandslinger heap. Moulds are sprayed with the following mixture:—24 quarts plumbago, 2 quarts bentonite, 2 quarts molasses and 24 quarts water. The moulds then are well skin-dried with an oil torch. If precautions are taken to skin-dry the mould shortly before casting, fairly good results are obtained by this method, although baked moulds are preferred when possible.

Characteristics of High-Test Irons.

From the data presented, it appears that the authors' normal mixtures—covered by four grades—have a silicon content ranging from 1.80 to 2.4 per cent.; Brinell hardness, from 156 in the softest to 217 in the lowest silicon content iron. Tensile strengths range from 10.7 to 17.8 tons per sq. in.

The standard plain high-test irons are characterised by low total-carbon content, varying from 2.63 to 3.09 per cent., and high combined carbon between 0.63 and 0.90 per cent., with 0.80 per cent. as the average. The silicon is generally in the region of 2.5 per cent., whilst the manganese is usually about 1 per cent. The phosphorus is about 0.70 per cent., and the sulphur 0.14 per cent. This mixture is fairly hard and yields Brinell hardness figures ranging between 228 and 261, whilst the tensile strength of the A.S.T.M. bars varies between 17.5 and 23.8 tons per sq. in.

The higher the combined carbon in high-test iron up to the eutectoid, the higher is the transverse and tensile strength. The Brinell hardness is considerably higher than with normal

Table III.—*Variation in Brinell Hardness of Arbitration Bar.*

Outside.	Centre.
228	217
241	228
241	241
241	228
255	241
228	228
269	255
241	241
255	241
241	228

iron mixtures; and, unlike these, shows very little variation from the outside to the centre of the arbitration bar. Normal mixtures average 207 on the outside of arbitration bars, but the centre varies from 207 to 149. Table III shows the uniformity in hardness from outside to centre of the arbitration bar on several heats of high-test iron. In general, but not always, the graphite is finer and more uniformly sized and distributed than in normal iron mixtures. The graphite varies considerably from the outside to a point half-way between the outside and centre of the machined tensile piece, but fine graphite is not always responsible for high strength.

Patternmakers' shrinkage on solid contraction is about half-way between steel and normal grey iron. It has been necessary to add more for finish on some patterns to take care of this. The deflection is lower than with the usual grades of iron, unless alloys are added. Transverse and tensile results are considerably higher than the results obtained with normal iron mixtures. Higher strengths and lower total carbons are obtained when two tons or more are melted.

High-test iron is more resistant to tool penetration than are normal iron mixtures, as indicated by drill tests. This probably is due to a greater density. There is nothing in the structure, however, that should ruin a tool if reasonable feeds and speeds are carried. There is no excess cementite present if the iron is of correct composition, melted properly and poured into castings having no machined section less than ¼ in.

Table IV shows the analyses and some physical characteristics of two heats representative of alloy high-test iron used for castings of very heavy section and machined very deeply, also for those having a thin section that may tend to become hard unless alloy is used. Part of the silicon has been replaced by nickel.

Table IV.—*Standard Alloy High-Test Iron.*

Mixture No.	T.C.	C.C.	Si.	Mn.	S.	P.	Ni.	Shrinkage. In./ft.	Brinell No.
1	2.79	0.66	1.73	0.78	0.163	0.09	1.39	0.14	228
2	2.86	0.71	2.09	0.91	0.160	0.09	1.05	0.16	217

Molybdenum-Treated Cast Iron.

Table V gives a record of the physical properties of mixture No. 3, to which was added varying percentages of ferro-molybdenum (up to 2 per cent.) at the spout, and also a heat of high-test low-carbon iron to which 2 per cent. ferro-molybdenum was added. A study of this table would seem to indicate that when using up to 2 per cent. ferro-molybdenum, the following results are obtained:—(*a*) Molybdenum raises the combined carbon, but not to beyond the eutectoid percentage; (*b*) it increases the transverse strength considerably; (*c*) it increases the Brinell hardness values; (*d*) it increases the tensile strength considerably; (*e*) it increases the time of machining as evidenced by drill test, but this is due to increased density or toughness and not to any hard spots or structure that would ruin a tool; (*f*) it decreases solid contraction or patternmakers' shrinkage; (*g*) it sorbitises the pearlite, leading to increased strength and toughness; (*h*) with molybdenum present, graphite flakes appear to be somewhat smaller and more uniformly distributed and sized—a further explanation of increased strength and toughness, and (*i*) molybdenum increases deflection.

It will be noted that molybdenum raised the strength of an ordinary steel mixture iron equal to the strength of some heats of high-test iron, and more than others. When this was noted, it was first thought that an iron treated with molybdenum might exhibit the same characteristics as a high-test low-carbon iron in reducing internal liquid shrinkage, porosity, sponginess or draws between adjoining thin and heavy sections.

Castings which were made with success without chills in high-test low-carbon iron were tried in molybdenum-treated irons (mixture No. 3 plus alloy, in Table V), but invariably showed the same defects exhibited by plain mixture untreated. That is, the authors cannot take an ordinary iron mixture which is giving trouble with sponginess or shrink in casting, and, by dropping in a little molybdenum, thereby produce a sound casting. An advantage of molybdenum is that it offers a ready means of obtaining fairly high transverse and tensile strengths without using mixtures containing high percentages of steel. However, it is thought that high-steel mixtures can be further improved in strength by molybdenum additions.

Apparently, molybdenum would be a valuable aid in ensuring consistently high strengths, inasmuch as the plain high-test iron tends to vary between fairly wide limits—say, 18 to 26.7 tons tensile.

Chromium-Treated Cast Iron.

In the authors' foundry most chromium-treated castings are of white fracture, non-machinable, and in use are subjected to high heat or to very severe wear. This iron is produced by adding 1 to 5 per cent. powdered ferro-chromium at the spout to steel mixture made from 30 per cent. steel, 50 per cent. pig and 20 per cent. returned scrap, analysing out at T.C. 3.2 to 3.4; Si 1.8 to 2.0; Mn 0.6 to 0.9; S 0.1 to 0.14 and P 0.2 to 0.30 per cent. A typical analysis of the product is: T.C. 3.25; C.C. 2.80; Si 1.80; Mn 0.80; S 0.13; and P 0.22 per cent.

Enough ferro-chromium is added to produce a white fracture throughout. Such irons tend to pipe badly if the design is at all difficult. External shrinkage often develops in corners or at the junction of varying sections when chromium is high. This is overcome ordinarily by a reduction of chromium, or sometimes by a change in design.

Table V.—*Molybdenum-Treated Iron.*

Mixture.	T.C.	C.C.	Si.	Mn.	S.	P.	Mo.	Brinell.	Transverse. Lb.	Deflection. In.	Tensile strength Tons per sq. in.
No. 3— 20% steel 50% pig .. 30% returns	3.38	0.68	1.88	0.76	0.098	0.24	0.0	196	1,994	0.25	13.5
No. 3, plus ¼% Fe-Mo	3.46	0.80	1.80	0.80	0.10	0.22	0.19	187	2,125	0.29	14.3
No. 3, plus 1% Fe-Mo	3.49	0.67	1.82	0.73	0.10	0.26	0.38	187	2,559	0.31	17.5
No. 3, plus 1½% Fe-Mo	3.45	0.77	1.85	0.81	0.096	0.23	0.73	207	2,692	0.32	19.7
No. 3, plus 2% Fe-Mo	3.41	0.81	1.89	0.80	0.096	0.25	0.82	228	2,843	0.30	21.1
High-test plus alloy*	2.97	0.82	2.92	1.07	0.162	0.10	0.82	302	3,071	0.32	26.5

* Made from 75% steel; 19½% high-test returns; 4½% Fe-Si; 1¼% Si-Mn; and 2% Fe-Mo.
The tests are made on A.S.T.M. bars.

Summary and Conclusions.

(1) High-test and alloy cast irons should be of great assistance to the foundry trade in promoting quality in certain difficult classes of work.

(2) The manufacture of castings from high-test irons requires considerably closer attention to details in melting, moulding and pouring than with usual grades of grey and steel-mixture iron.

(3) There is a rapidly-expanding market for castings having superior or special qualities, and the possibility of producing such castings should do much in advancing the grey-iron industry.

(4) The production of high-test castings results in higher costs, due to the necessity of using more expensive materials, more expensive moulding methods, lower fuel ratios and a high proportion of foundry returns to good castings produced.

(5) Castings of high-test iron do not machine quite as readily as do the usual grades of iron. They offer more resistance to tool penetration, but are free from hard spots or structures that would ruin a tool, if such irons are properly made and poured into castings of proper sections.

(6) Dry-sand moulding generally must be followed in the production of high-test castings, to ensure sound, clean and good-surfaced castings.

(7) The slight variation in hardness from the outside to the centre of the arbitration bar is noteworthy and a high tribute to the homogeneity of high-test iron.

(8) The deflection values of high-test irons are lower than the usual grades, unless alloys are used.

(9) Solid contraction (patternmakers' shrinkage) in high-test iron is considerably higher than in the usual grades of iron.

(10) In general, the graphite is finer and more uniformly sized and distributed in high-test iron than in the usual grades of iron.

(11) Transverse and tensile strengths are considerably higher in high-test iron than in the usual grades of iron, and tend to be at a maximum at the eutectoid point.

(12) The photomicrographs for graphite study depend to a large extent on where they are taken, as there seems to be a considerable variation in the graphite size and distribution from the outside to the centre of the tensile piece.

(13) High-test iron is invaluable for overcoming internal liquid shrinkage, sponginess, draws between adjoining light and heavy sections or porosity in castings of difficult design.

(14) External liquid shrinkage is much greater in high-test iron than in the usual grades of iron, necessitating the use of large risers to eliminate surface depression.

(15) Nickel has a very decided advantage with certain castings in obtaining ease of machining without sacrificing closeness of grain, in elimination of chilled sections of thin castings, and in further improving the quality of high-test irons.

(16) Molybdenum is of value in lessening solid contraction, in increasing transverse and tensile strengths, and deflection values on both the usual grades of iron and on high-test iron.

(17) Chromium is a convenient medium for readily turning a grey iron into a white iron, thereby obtaining valuable properties such as wear resistance and resistance to growth.

(18) The technique involved in the manufacture of high-test and alloy cast irons will be improved as further knowledge of the subject is acquired.

Beryllium Ore in the Transvaal.—Phenacite (a beryllium silicate ore) has been found on a farm in the North Eastern Transvaal in lode form between norite and granite. Samples are reported to assay 12.80 to 15.42 per cent. beryllium. The occurrence has been proved for over a mile and a-half.—"Chemical Trade Journal."

Famous Men of Carron.

From the foundation of Carron Works more than 170 years ago, the resources of science and the skill of some of the greatest men of science have been brought into use by Carron Company. In a series of pamphlets a peep is taken behind the veil of romance which surrounds the name of Carron, to dwell briefly on a few famous men connected with the early history of the company —men whose praises are to-day rarely sung, but who, nevertheless, in the different spheres, performed outstanding service for the benefit of mankind. In the sixth pamphlet of the series, reference is made to a man with a Carron connection whose name has become a part of the English language. Major-General Henry Shrapnel who was born at Midway, in Wiltshire, on June 3, 1761.

Shrapnel entered the Royal Artillery as a second lieutenant in 1779, and at an early age began, at his own expense, the experiments which, eventually, led to the invention of the death-dealing shell that bears his name. As is well known, shrapnel is a type of shell containing a large number of bullets which are released and travel forward at high velocity when the shell is opened by the bursting charge. Shrapnel was adopted in the British Army in 1803 and appears to have been first used at the siege of Surinam in 1804. The efficacy of the shell was fully demonstrated in the Peninsular War.

It is interesting to know that the shrapnel shell was first manufactured at Carron Works, and that many of the early firing tests of the shell were carried out, under the personal supervision of the inventor, on lands near Carron. The selection of Carron Works instead of one of the Royal Arsenals, for this important step forward, is not a surprising one because in the early days of the nineteenth century Carron Company had a world-wide reputation for the casting of ordnance of all kinds, including the famous "Carronade" guns. An original document is still extant addressed by Carron Company, on October 10, 1804, to Lieutenant General Ross, of the Honourable Board of Ordnance, London, which sets forth that the company "has suffered very considerable inconvenience by being kept out of the money due for stores sent to Dublin, Leith and other places for the accommodation of your Board," and requesting him to give direction that the "bills brought into your office as Surveyor-General and not yet payed, be payed without delay." The letter continues:—"I am satisfied that, upon enquiry, you will find the bills to which I refer are all in a situation to be payed, particularly the sums due for the work done under the direction of Major Shrapnel"; and it also gives "particulars respecting the business done under Major Shrapnel's orders," the items including "Spherical Case Shot certified by Major Shrapnel in September and October, 1803, £4,587 11s. 2d.; do., shipped on board the 'Melville Castle' for Dublin in November, £596 9s. 8d.; and do., shipped on board the 'Princess Elizabeth' for Dublin in November, £1,455 14s. 8d.," together with "expenses incurred by Major Shrapnel's experiments at Carron in 1803, £191 11s. 10d." The invoice book of the company under date December 31, 1803, also gives a list of "sundry articles furnished Major Shrapnell for his various trials of the Spherical Case Shot," including over 1,300 spherical case shot ranging from 3 pdrs. to 68 pdrs. at from 6d. to 5s. each, and "Thomas Smith, tenant, for damage done to his farm, £5 5s."

Carron Company have in their possession some of the original specifications and diagrams of the shell written and signed by Shrapnel, as a lieutenant-colonel of the Royal Artillery.

In addition to producing shell, Shrapnel was responsible for other inventions in connection with the improvement of artillery. He retired from the active list with the rank of major-general, and died at Southampton in 1842.

Book Review.

Wealden Iron, by Ernest Straker. Published by G. Bell & Sons, Limited, Portugal Street, London, W.C.2. Price 15s. net.

Immediately on opening this fascinating book, one tenet of the industrial catechism is shattered, for it has so often been stated that the Elizabethan Admiralty requirements for oak for ship construction were responsible for the decline of the Sussex iron industry. Actually, it was the inability to substitute coal for charcoal which led to its complete suppression, for many exemptions were granted to the Wealden ironmasters to cut wood for charcoal. Chapter I presents data which on iron in general are well known to our readers and can be skipped, but the second must be studied to appreciate how a comparatively small area found employment for 8,000 operatives when this industry reached its zenith. The chapter also deals with primitive methods. This is an essential, because the lay mind has difficulty in visualising the various processes of producing iron, and the product, whether of the cast- or wrought-iron variety.

The perusal of Chapter IV—Early History—impresses on one the strong interconnection of iron working with politics, religion, pestilences, law and war. Superficially, beer must have been very cheap in the 14th century, as a penny a week, shared amongst four, was the normal allowance. After dealing with the development of the blast furnace, which, by the way, may mean either a cupola or a furnace for producing pig-iron from the ore, a description first given by Ray in 1672, is reproduced on page 44, and refers to the production of wrought iron by a firm, representing an early successful attempt at vertical trustification. Yet long prior to that, in 1543, the business of casting cannon was commenced in Sussex at Buxted. From this point the author traces the development and decline of the district from the Tudor era to the Hanoverian. His scheme is then to deal with each phase of the industry, starting with the hammer ponds, then describing the melting furnaces, forges, cinders and slags, ore mining and fuel.

Chapter XV opens up the subject of the products of the ironworks, and first details the manufacture of guns. The famous petition of Ralph Hogge for an order to enforce the prohibition of the export of guns is reproduced. From the description by Fuller of gun moulding at Heathfield (pages 156 and 157) it appears that the pattern—the word model is used in the text—was made like a loam core and involved the use of haybands, cowhair and manure, but no workable description of its use in moulding is given. On page 161 the word "coquelles" is used in connection with the casting of shot, which gives us the impression that in 1790 it was customary to use permanent moulds for this class of work. The author has seen fit to make a note that Wadhurst clay was particularly suitable for making patterns and moulds; from its position to-day we would advance the claims of Erith loam. Firebacks, grave slabs and irons are next described, and a number of excellent illustrations are included.

We rather appreciated the author's remarks, when outlining the system of leasing forges. He says "the conception of the waste of capital by depreciation and obsolescence did not enter into the minds of our forefathers any more than it does to-day in Inland Revenue matters or in railway accounts." This is culled from the chapter on finance, and we find here a certain amount of repetition from an earlier chapter.

Part II, which comprises more than half the book, contains a detailed survey of the Wealden sites of mines, forges and furnaces, and is largely the result of personal investigation by the author. It is fully illustrated with clear maps and reproductions of photographs. Some of the latter might with advantage, however, have been a little larger and clearer. The book is excellently indexed and forms a notable contribution to the history of metallurgy.

Refractory Materials for the Induction Furnace.*

By J. H. Chesters and W. J. Rees.

The development of electrical methods of metal melting, by induction heating, has raised many difficult problems in the production of durable linings. Apart altogether from refractoriness and chemical durability, the lining must resist the severe strains imposed on it by the rapid rate of heating and by the steep temperature gradient between the molten metal and the water-cooled coil. Linings are now available which are reasonably durable under normal conditions, and which are unlikely to fail disastrously under brief periods of abnormal treatment such as may occur during a superheat. In this Paper the development of these linings and the methods of testing lining materials are described, and possible future developments are discussed.

Although much has been written about the induction furnace, very little information is available with regard to the linings used or the degree of success obtained with these linings.

Linings for the Horizontal Ring-Type Furnace.

Silica bricks were used for lining the first furnaces of this type, but were not very durable, and the charge tended to take up silicon from the lining. Later, dead-burned magnesite or dolomite bonded with tar was used. The use of fused magnesia has been described by Unger. Various bonds, such as magnesium sulphate, were tried, pitch being chosen as the most suitable. The pitch yields a coke which holds the refractory together until a temperature is obtained high enough to sinter the lining. The solid ring or template was placed in the furnace as a former round which the material was rammed. The grading of the lining was carefully controlled, and the pitch had to comply with certain specifications—for instance, the moisture content must be less than 1 per cent. The magnesia used was relatively pure, the chief impurities being silica 3 per cent. and lime 3 per cent. The lining showed no signs of softening at 2,000 deg. C., and gave a metallic ring when struck at the working temperature. Such a lining was said to average four hundred melts when melting steel. No patching was required for the first hundred melts. Rodenhauser, Schoenawa and vom Baur also mention the necessity of using a suitable grading and tar, and say that the lining life on a Kjellin furnace is between four and eight weeks.

Linings for the Coreless-Type Furnaces.

Although a considerable number of lining experiments have been made with this type of furnace, very little information as to the durability of various materials has been recorded.

Crucibles.—The simple design of these furnaces makes possible the use of an ordinary cylindrical crucible. In the early days most of the melting was done in crucibles; thus, Campbell describes the use of a fireclay crucible, held in position by zircon-sand insulation. Such crucibles were said to last ten to thirty melts on nickel-iron alloys. Large quantities of cable metal are still melted in fireclay crucibles, although now most of the work is done in sintered linings. Dörrenberg and Broglio have succeeded in almost doubling the life of fireclay crucibles by modifying the shape from the usual cylindrical form to one in which the crucible is cylindrical at the top but tapers towards the bottom.

Lined Crucibles.—Several workers have attempted to line crucibles either in order to increase the life, or to avoid contamination of the melt by the carbon from a graphite crucible. Thus, Northrup mentions the use of graphite crucibles lined with magnesia or zirkite. Riddick describes attempts made to find a suitable lining for a 100-lb. graphite-china-clay pot used for melting a high-nickel alloy, the carbon content of which must not exceed 0.05 per cent. Various materials such as zircon, sillimanite, diamel and magnesite were tried in the form of pastes applied to the inside of the crucible. Some failed by cracking, others by permeation of the lining, causing carbon contamination of the melt. The most successful lining was made from an Arcofrax-flint mixture bonded with ball clay. The crucible was first fired to 815 deg. C. before the lining was applied. The material was then put on with a brush until a thickness of about ¼ in. was obtained. The lining was thoroughly air-dried before the crucible was used. The life of such linings only averaged about four melts.

Rammed Linings.—Neuhauss describes four methods for lining coreless furnaces. In the first, the lining material is mixed with a bond, and rammed between the coil and a central former. The former is then removed, and the lining sintered by radiating it with an induction-heated graphite core. This method is said to work well with acid linings—for instance, Pfalzer-luting sand—but with basic materials the second method is used.

In the second method, a thin lining is first made as described above. The graphite core is then removed and a patent centrifuging appliance is used to deposit a layer of magnesite powder on the walls of the lining. The core is then replaced and the lining radiated. The process is repeated until the desired thickness of lining is obtained. The centrifuging device may also be used for patching furnace walls.

The third method has been largely employed for lining core-type furnaces. Rohn has studied this method in its application to coreless induction furnaces, and particularly vacuum furnaces where the use of a volatile bond is undesirable. and has patented the use of dry granular material in place of slightly moist material or material mixed with tar. The charge is placed in the liner and the power applied. The liner heats up and eventually splits. A melt forms at the bottom of the charge and the liner generally slides down into the melt, leaving behind it a wall of sintered material. Experience in the use of this method suggests that in the lining of coreless furnaces it is not essential for the lining materials to be moisture-free.

In the fourth method, a clay-bonded magnesite crucible is placed inside the coil, and the space between the coil and the crucible is packed with magnesite powder. On induction-heating the charge in the crucible, the magnesite sinters on the outside of the crucible, forming a lining thicker than the original crucible. This method is limited by the difficulty of making large crucibles of materials like magnesite.

The most popular method of making linings, the third, is essentially a compromise. If the lining is to be durable it should be as refractory as possible, but if it is too refractory the thickness of sinter obtained will be insufficient to stand the thermal and mechanical strains to which it will be exposed. If the sintering is only slight, the top of the lining is liable to fall in when the liner slides down into the melt. With basic materials, sintering is usually obtained by adding a flux, such as boric acid, to the lining material. For acid linings, mixtures of raw and calcined ganister (or other comparable quartzite) bonded with boric acid, borax or boric-acid glass are most favoured. Crushed silica-brick is a constituent of some mixtures which have been used, but its inclusion does not appear to effect any improvement in the linings.

Properties Essential in Induction-Furnace Linings.

In the coreless type of furnace the working conditions are severe, and great variations in lining life will occur unless the materials used are carefully controlled. As already indicated, the production of a lining by the use of an induction-heated liner is essentially a compromise, and the information available is not complete enough to make possible an accurate analysis of the relative importance of all the factors involved in lining life.

Ability to Sinter.—The temperature reached by certain parts of the lining, in particular the region just above the slag line, is not very high, and in general the lining is "let down" with a flux in order to achieve a sufficient thickness of sinter to avoid crumbling or falling-in of the lining. Even if the top of the lining does not fall in, the thickness of the sinter may be insufficient to stand the thermal strains caused on cooling or the mechanical strains produced by the loading of a new charge. The cracking of the lining does not necessarily require a shut-down, but if the sinter is thin a piece of the lining may fall out, and then the loose material behind it falls in.

The importance of grading in aiding sintering will be considered later. With acid lining, grade 1, Table I, is often used. With basic linings the grading is more often of the type 2, though it is likely that a grading of the type 1 would be equally suitable, if not better.

Table I.—*Details of Grading of Lining Materials.*

Sieve sizes.	Grading 1.	Grading 2.
I.M.M.		
On 20 mesh	45	20
Through 20 and on 60 mesh ..	10	30
Through 60 mesh	45	50

Corrosion Resistance.—Linings in coreless induction furnaces usually fail through corrosion and erosion. From time to time statements have been made as to the heavy erosion expected in such furnaces, owing to the swirling motion of the charge. There is, no doubt, some truth in this suggestion, but the fact that the maximum wear has been observed at various positions between the top and the bottom of the furnace suggests that this is only one factor in the wear.

The importance of the bond as a factor in slag resistance is not very clear. At first it was thought that the addition of a non-refractory bond would permit of slag entry between the grains, and thus allow the loosened grains to fall out into the melt. The results of high-temperature tensile work now in progress, however, tend to indicate that the bond is of less importance than was hitherto thought. Thus, it is found that the addition of an induction-furnace slag to a magnesite bar does not lower the breaking temperature under a given load, the natural bond in the material being of such a relatively-low melting point that the addition of a relatively-refractory slag does not affect the hot strength.

The entry of slag between the grains must, however, increase the rate of solution of the material, and hence the use of a bond of the maximum refractoriness, consistent with good sintering, would seem advisable. The relative importance of the factors controlling slag resistance requires further research, but here again the importance of using a grading giving a dense packing cannot be over-emphasised.

Burning Shrinkage.—With basic linings, failure sometimes occurs owing to excessive cracking. Generally a crack is unimportant, since it fills up with loose material from behind and may disappear completely during subsequent melts. In certain cases, cracking becomes more and more serious until a shut-down is necessary. It seems likely that such cracking, which has only been observed in basic linings, is due to shrinkage accompanying the continued crystallisation of the magnesia. Attempts have been made to avoid this by the addition of zircon to

* Paper read at the Annual Meeting of the Iron and Steel Institute in London.

the lining. The tests made were not very exhaustive, but it would appear that the resultant material does not possess the high slag resistance of magnesia.

Testing and Control of Lining Materials.

Grading and Sintering.—The exact relation between grading and sintering cannot be stated, but it is well known that the use of too coarse a material, or of a material of approximately one grain-size, makes sintering more difficult. It is obvious that a material containing grains of various sizes will give a much greater area of contact between grains than that obtained with a coarse even grading, whilst it is also known that the solubility and vapour pressure increase with decreasing grain-size. The importance of grading is shown by the following example of a failure due to lack of fine grains.

A lining was made from a new batch of basic-lining material, but failed owing to insufficient sinter—the lining top falling in when the liner slid down into the melt. The material was sieved and found to have the grading given in Column 1 (Table II). The grading of a similar material, which had been successfully used on previous melts, is given in Column 2. Part of the new material was ground and remixed with unground material, giving a mixture of grading as shown in Column 3. A lining made from this material sintered well, the only change being one of grading.

A convenient method of testing the ability of a new mixture to sinter is to ram a small crucible with the new material and another with a material which is known to sinter well. The two crucibles are then heated together to 1,500 deg. C. and allowed to cool. The strength of the sintered cores may then be compared. This method proved useful in showing that the failure described above was due to bad grading, and might be obviated by suitable grinding of the new material.

Table II.—*Grading of Basic-Lining Material (per cent.).*

Sieve sizes.	1.	2.	3.
I.M.M.			
On 20 mesh	35	20	20
Through 20 and on 60 mesh	50	35	20
Through 60 and on 120 mesh	10	20	20
Through 120 mesh ..	5	25	40

In order to overcome the reduction in the refractoriness of a lining due to the addition of a flux to cause sintering, experiments were made in which the steel liner was coated with a layer of silicate of soda. Austrian magnesite was used for the lining material, and no flux was added. Although the thickness of sinter obtained in this way is not great, it is sufficient to permit of a lining being made, and a further increase in sintering may be obtained by holding a molten charge in the lining for some time. The results are not conclusive, but the tests seem to indicate that a lining made in this way is more durable than one containing an added flux.

Besides the original Rohn method for the sintering of induction-furnace linings, certain other different or modified methods have been patented. Thus G. A. Wood and N. R. Davis have patented the use of a lining in which the amount of flux present varies both horizontally and vertically in such a way that a uniform thickness of sinter is obtained over the whole of the lining.

Corrosion Resistance.

Although laboratory slag tests do not permit of close correlation with large-scale practice, the results obtained are useful in studying the nature of the attack and in eliminating poor materials which might cause a serious breakdown on a large-scale trial. In order to simulate the conditions in large furnaces the slag tests were carried out in burned crucibles, made from the lining material.

Tests on Small Crucibles filled with Slag and Heated.—A large number of tests have been made on small crucibles of about 15 cub. cm. capacity, which were filled with slag and heated in a gas furnace to about 1,500 deg. C. The crucibles were then examined, both superficially and by cutting thin sections for microscopic examination. The appearance of the slagged crucibles varied considerably with the different materials tested.

Tests on Crucibles used to Melt 10 lbs. of Steel.—A number of crucibles were made of the approximate size and shape of 2-lb. jam-jars, and were tested by using them for melting steel in a high-frequency valve-type furnace. Considerable difficulty was encountered in making crucibles of non-plastic materials with such a small wall-thickness (¼ in.). The results obtained with these crucibles agreed with those derived from the small crucible tests, and gave a useful indication of the probable behaviour of the lining material. The degree of correlation obtained will be seen from the following examples.

Austrian Magnesite.—A small crucible made from this material withstood slag attack very well, though not without some absorption. A "10-lb. crucible" of the same material showed good slag resistance when melting steel, but cracked owing to thermal shock. Fig. 1 is a micrograph of a section through this crucible. Although the slag attack appears to be superficial, a thin section shows quite clearly that the slag streams around the magnesia grains and passes right through the crucible wall. The grains near the dark slag face show signs of attack. Microsections cut through magnesia linings are very similar in appearance to slices through small crucibles or 10-lb. crucibles. Fig. 2 shows the slag, held in the corner of a small crucible, at the end of a test. In this case the black grains are the magnesia, the periclase having absorbed iron oxide from the slag. The crystallisation of magnetite may be observed in the slag, some of the crystals appearing in a rather extraordinary cross-like form.

Electrically-Fused Magnesite.—Fig. 3 is a micrograph of a thin section through a small crucible made from this material and used on a slag test. The slag resistance of the material was high, but, as can be seen from the illustration, severe slag entry took place along small cracks in the material. Although the slag itself is colourless, the periclase grains are darkened by the iron oxide brought in by the slag.

Zircon-Ball-Clay Mixtures.—Crucibles made from such materials appear to have a very good texture, but permeability tests reveal that the material is very open, due to the even grain-size of the zircon. A pot made from this material failed, apparently through softening, when used in the induction furnace. Fig. 4 is a micrograph of a section cut through this crucible. It shows that the failure was not due to attack on the zircon, but to the corrosion of the ball clay and the consequent collapse of the material. Essentially similar results were obtained in slag tests on small crucibles. Such tests show the importance of preliminary laboratory tests in avoiding the use of unsuitable materials in large-scale trials.

Silica.—A large number of crucibles were made from crushed silica-brick, bonded with various materials, such as boric acid, silicate of soda, bentonite, etc. Although the superfical appearances of the slagged crucibles were often similar, the examination of micro-slices revealed the fact that the amount of quartz conversion and tridymite formation taking place during slag attack varied considerably with the bond used.

Magnesia-Zircon (70/30) Mixture.—The slag resistance of this material, both in the small-crucible test and as a 10-lb. pot, appears to be less than that of magnesia alone. The results obtained in large-scale trials were in agreement with this indication, whilst the reactions between slag and lining and between magnesia and

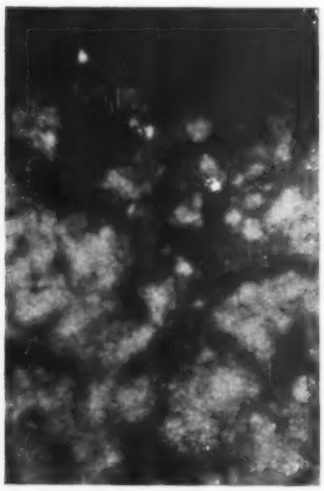


Fig. 1.—Magnesia Crucible. Slag Penetration. × 100.

Fig. 2.—Slag contained in Magnesia Crucible. × 30.

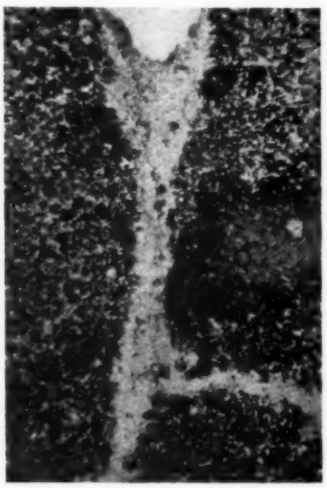


Fig. 3.—Fused - Magnesite Crucible. Penetration via Cracks. × 100.

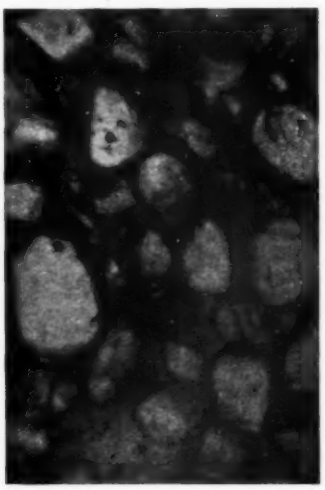


Fig. 4.—Slagged Zircon-Ball-Clay Crucible. × 100.

zircon appeared to be essentially the same in each case.

The burning shrinkage of a lining material was determined by making a briquette, 4½ in. long, and burning it to 1,500 deg. C. With some basic-lining materials the shrinkage was of the order of 6 per cent. The effect of varying the bonding material or of adding other materials is readily determined by this method.

A simple apparatus has been designed for testing the permeability of burned materials. A briquette is made and clamped over the open side of a brass box, being sealed in position by plasticine. The leakage of air through the briquette causes the collapse of a vacuum, created in the apparatus by means of a filter-pump. The time taken for a given fall in pressure is directly proportional to the permeability resistance of the material, and may therefore be used as a measure of this quantity. An even simpler method consists in filling a saturated crucible with water and noting the time taken for it to empty. Both methods yield approximate values, materials with a very rapid leak defying accurate timing, and those with a very slight leak requiring a more perfect type of seal.

Large-Scale Lining Tests.

Three methods suggest themselves for testing induction-furnace linings: *Method* 1.—Make a lining and run it to destruction, determining either (*a*) the time it lasts whilst holding a molten charge, or (*b*) the number of melts obtained with a given melting procedure. Bar-iron seems to be a suitable material for use in such tests. *Method* 2.—Make a lining; hold a molten charge in it for a given time, and then estimate the corrosion by measuring the lining diameter in a number of positions. *Method* 3.—Make a lining and measure it; then ascertain the number of melts or the time required to produce a given amount of wear.

Most of the information with regard to lining life is based on (1) *b*, but unfortunately the charges used are rarely similar, and even if a record is kept of the materials melted it is very difficult to estimate the relative corrosiveness of various melts. An attempt has been made to formulate so-called "wear values" by taking a medium carbon steel (carbon 0.80 per cent.) as a standard of corrosiveness, and then expressing other materials as having a wear value x, where x is the ratio of the wear produced by this material to that produced by the standard material. On this basis one steel-melting firm gives the following wear values: 1.4 to 1.5 per cent. carbon steel, 0.9; 0.8 per cent. (medium) carbon steel, 1.0; 1.5 per cent. chromium, 0.9 per cent. carbon steel, 1.2; high-speed steel, 1.7. The figures were obtained by the ordinary crucible steel-melting process, using plumbago crucibles.

Dörrenberg and Broglio have obtained the following wear values with clay pots used in induction furnaces: Steel (1.0 per cent. carbon), 1.0; medium-alloy and medium-carbon steel, 1.5; high-alloy steel, 2 to 3; certain alloy steels, 4 to 6. The above figures are interesting, and serve to show the different wear produced by various materials. It would, however, be unwise to expect the same wear values with either basic or acid linings. The melting time, the degree of superheat, and the slag produced all greatly affect the results obtained. Thus, in one trial on a magnesia-zircon lining, a first run on scrap steel (medium-carbon) showed very little corrosion; a second run on rusty bar-iron showed a reduction in lining thickness of ⅜ in., whilst a third run on scrap steel again showed very little corrosion. The most significant results are obtained when a large quantity of one material is being melted, and the melting conditions are essentially the same with consecutive linings.

A number of tests have been made on the effect of varying the grading of the lining material. Thus, at one time the grading of an acid lining used in a particular furnace was of the type given in Column 1, Table III, and twenty-five to thirty melts were obtained with mild steel. A change to the grading given in Column 2 resulted in a life of forty melts being obtained.

Table III.—*Grading of Acid-Lining Material (per cent.).*

Sieve sizes.	1.	2.
I.M.M.		
On 20 mesh	8	35
Through 20 and on 60 mesh	27	16
Through 60 mesh	65	49

Besides the approximate grading given above, it is very desirable that the nature of the "through 60 mesh section" be examined. Thus, in one case a sudden fall in lining life from about forty to four melts per lining occurred. The approximate grading of the material had remained constant, but the amount of "very fines" (through 120-mesh) had gone up, as shown in the difference between Columns 1 and 2, Table IV. This resulted in a separation of the larger grains, giving a "lubrication" effect which made ramming very difficult, and resulted in the formation of pockets in the lining, which later caused localised attack.

Table IV.—*Further Grading of "Through 60-Mesh Section" (per cent.). See Table III.*

Sieve sizes.	1.	2.
I.M.M.		
Through 60 and on 120 mesh	34.5	15.0
Through 120 mesh ..	27.0	42.0

The use of calcined ganister bonded with boric acid has led to an increase in lining life, the grading found best being of the type:—*Sieve Size* (I.M.M.).—On 20 mesh, 45 per cent.; through 20 and on 60 mesh, 10 per cent.; through 60 mesh, 45 per cent. Of the "through 60-mesh section" approximately half should go through 120 mesh. One such lining gave a life of sixty melts with various materials.

(To be continued.)

Modern Nitriding Practice.

At a meeting of the American Iron and Steel Institute held in New York recently, Mr. Marcus A. Grossman read a Paper entitled "An Appraisal of Nitriding," in the course of which he pointed out that the nitriding process, if handled properly, gave surface hardness with practically no distortion. The only possible distortion occurred if the pieces were supported improperly while at temperature during nitriding, except in certain circumstances. There was, however, a very slight increase in size, commonly termed growth, which was usually negligible, but which in specific cases must be taken into account. The amount of growth was of the order of 0.001 to 0.002 per in. at the usual nitriding temperatures, but was greater when the nitriding temperature was higher. This was an additional reason for avoiding high nitriding temperatures in the initial stages. This same growth may also in certain cases cause distortion. Obviously, if a thin sheet is nitrided and is protected on one side from nitriding (as by tinning), the unprotected side will nitride and grow, causing the sheet to curl. Similarly, pieces of complicated shape with marked differences in cross-section may suffer distortion from similar causes.

Present Practice.

Present practice in nitriding steels was to give the hot-rolled steel a preliminary heat treatment, consisting in quenching or air-cooling from above the critical temperature, say from 925 deg. to 850 deg. C., and then to reheat to some temperature which was above the temperature of nitriding. Obviously, if the reheating or tempering was done at 705 deg. C., a subsequent nitriding at 510 deg. C. was not likely to affect further the core properties. However, a useful second nitriding stage at 620 deg. to 650 deg. C. was often practised to advantage after the 510 deg. C. nitriding, in which case the preliminary tempering before nitriding should be governed accordingly.

The hardness and wear resistance of nitrided steels could still be claimed to be higher than those obtained by any other steel-treating process.

Nitrided parts were free from internal stresses and therefore free from aging effects, regarding which the author drew attention to two factors. First, the quenching stresses were present in hard heat-treated steels, because they arose in the necessary quench and because a tempering temperature which would dissipate the stresses would reduce the hardness, whereas the slow cooling which followed the nitriding leaves practically no stresses. Second, the temperature at which nitriding proceeds was so far above room temperature that even indefinitely-long periods of time at room temperature induced no ageing of the hard nitride structure. Conceivably a change could develop, especially if the proper nitriding temperature happened to be lower than it was, but the facts were that no such change develops.

With regard to ageing effects, it was perhaps proper at this point to mention temper brittleness, which was sometimes, but not always, encountered when nickel was used in the alloy. This temper brittleness, which developed on cooling from the nitriding, was a phenomenon whose nature was not yet well understood, and, although it was often found when nickel was present, it did not necessarily or universally accompany it.

Continuing, the author pointed out that to take full advantage of the rust resistance, which was often present, it was advisable to use the original nitrided surface wherever possible and to do no grinding after nitriding.

At the present time, practically all nitriding was done in ammonia. A suggestion had been made by Kinzel and Egan regarding the use of molten cyanides, which give a hard but extremely thin case. Circulating ammonia gas is the almost universal present-day nitriding agent.

The use of a fan was found to overcome the lack of uniformity in different pieces in the same nitriding box.

Surface oxidation, especially decarburisation, had been shown to result in a very brittle (almost friable) case. It should be emphasised that this matter of surface oxidation was one of the most serious causes of failures encountered in present-day nitriding practice. The statement had been made that the presence of decarburised, oxidised surfaces before nitriding led to more failures of nitrided parts than any other single cause. These defective cases were very brittle and resulted in early spalling of the piece in service. Foreign metals susceptible of nitriding sometimes had an unexpected effect in retarding nitriding, and this was equally true of the nitriding containers themselves. Foreign substances in the ammonia, such as benzole, had at times been used in an attempt to minimise decarburisation.

Overseas Trade Development Council.

Mr. G. M. Gillett, M.P., Secretary of the Department of Overseas Trade, announces that, in accordance with the arrangement whereby membership of the Overseas Trade Development Council is reviewed annually, the Council has been reconstituted as follows, with effect from August 1, 1931:—

Mr. G. M. Gillett, M.P. (Secretary, Department of Overseas Trade), Chairman; Sir E. T. F. Crowe, K.C.M.G., Sir Alan Anderson, K.B.E., Sir Arthur Balfour, Bt., K.B.E., Sir Francis Joseph, C.B.E., J.P., Sir William Larke, K.B.E., Mr. L. W. Matters, M.P., Mr. W. Thow Munro, Mr. J. G. Nicholson and Sir Gilbert Vyle.

XUM

Technical Co-operation.

Strong pleas for the close co-operation between the various sections of foundry executives were made in the discussion on Mr. R. Arzen's Paper on "The Laboratory and the Foundry."* It was opened by the reading of a communication from Mr. Horace J. Young, who said: A laboratory, unless it is a research department, is solely a means of measurement, which needs to be as accurate and speedy as the circumstances necessitate. Measurements of all kinds are valueless or valuable according to the skill of the man using them. For example, a bridge is to be thrown over a river, and somebody comes and measures up the field of action. This same set of measurements placed in various hands will result in (1) a good but expensive bridge, (2) a good but inexpensive bridge, (3) a bad bridge at any price, or (4) no bridge at all.

To say that modern conditions demand that we have science in our ironfoundries is, from the point of view of a business man, a platitude. Sometimes it is true provided the science is good and experienced science, sometimes it is untrue under any circumstances.

To state a case—there is a foundry possessing a big laboratory, where it would be good to shut up the laboratory and where it would be possible to save the firm the whole of its laboratory costs plus large sums of money which they are expending unnecessarily upon expensive materials when cheaper ones would do the job as well. The cost of doing this might be about £300 per annum, while the money saved annually would be almost certainly ten times that amount. In another case, the foundry is under a manager. Here the same applies, with the exception that there are no laboratory costs to be saved, because there is no laboratory. In a third case, the foundry is making castings, using about 80 per cent. scrap and highly-phosphoric pig-iron. No scientific control could justify itself here, as any raising of costs of production is prohibitive.

Where Scientific Control Succeeds.

The value and use of scientific control applied to an iron foundry lie in one or more of the following directions and seemingly in no others:—(1) Being able to use cheaper materials and obtaining the same or better results; (2) reducing the number of wasters if these are abnormal, and it can be done without putting up the cost; (3) improving the quality of the output, always supposing that the firm can get more orders as the result of so doing; (4) standardising each quality of iron made by the foundry so that (*a*) it never differs in its foundry qualities or in its behaviour in the machine shops; (*b*) it always gives the same results in service; and (5) noting the behaviour of each quality in service and so being able to improve the irons in those directions shown to be the right ones. There are enormous financial and economic advantages to be gained, particularly in view of the fact that thousands of pounds are wasted annually by foundries using expensive raw materials when cheaper ones would do as well or better if used by someone with experience and knowledge.

While agreeing, as everyone is bound to do, with the main theme of the author's Paper, there are one or two details which the writer looks askance at. For example, sand-testing can be done *ad nauseam* and to no practical or commercial value, save in certain foundries, particularly those engaged in machine moulding and mass production. So far as cupola control is concerned, the writer has failed to find any particular value in waste-gas analysis, as there are no certain methods of obtaining concordant results. Further, the diagrammatic recording of blast pressure and volume is of little use unless the pressure and volume can be standardised at will and throughout each heat—in such case, a diagrammatic record is then little more than an ornament. The author states that "the combination of the figures given by gas analysis and metal temperature should indicate the amount of coke necessary and the optimum blast conditions." As a matter of fact, this is impossible, for the simple reasons that gas analyses vary enormously, and the taking of absolute temperatures of the molten metal by optical pyrometer is a problem yet to be solved.

The last paragraph of the author's Paper is significant, and can be strengthened because the practical foundryman is able to do much without the help of a chemist, while the latter can do little or nothing without the help of a practical foundryman. Moreover, why call the man a "chemist," when, in this country, the term may mean he is a pill manufacturer or an analyst, neither of which can effect the results desired. The man we are talking about is a foundry metallurgist.

New Type of Executive Wanted.

Mr. A. S. Beech said the Paper was interesting, although it did set out a number of matters which were well known to all foundrymen and with which everybody must agree, but one point that should be stressed particularly was the concluding paragraph of the Paper, to the effect that the metallurgist—he would not call him a chemist—should try to visualise foundry problems not only from their scientific aspect but also from the practical foundryman's point of view. His experience at foundrymen's meetings such as these was that when a man got up and spoke about any particular matter, it was quite easy to tell from the way he handled it exactly whether he was a metallurgist or a practical foundryman, and the difficulty was that so many problems were dealt with either from one point of view or the other, and were not regarded in a co-operative spirit as between the practical and scientific side. To expect to get in one man the ability to deal with both the scientific and practical side was, perhaps, rather difficult, but if it could be done it would be a contribution towards the improvement of the foundry in the future.

Mr. W. T. Laverton, referring also to the conclusions in the Paper, said practical foundrymen would appreciate the statement that "As a final piece of advice, the author would ask the chemist not to regard the practical foundryman as being devoid of intellect, and the foundry executive not to imagine that the chemist has been brought in either to interfere or to spy." It was to be regretted that very often in the past the more or less narrow view had been taken in the foundry that the chemist or metallurgist was there to spy and not for the purpose of assisting and mutually co-operating. To-day's standard of education, however, had removed a great deal of that, and we could now look forward more and more to the time when there would be complete co-operation between the scientific and practical sides in a firm, and to the time when the metallurgist would no longer be looked upon as a source of interference or as in any way spying on the work of the foundry. That mental attitude between the two branches had frequently been found to help to solve a problem which had previously been insoluble.

* Presented at the Birmingham Convention of the Institute of British Foundrymen and printed in our issue of June 18, p. 413.

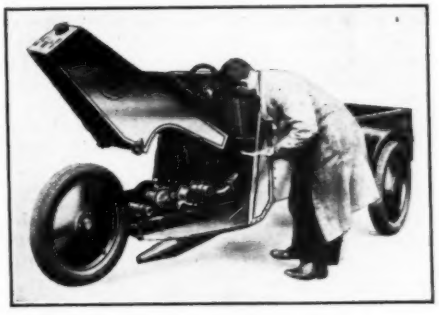
International Foundry Conference, Milan.

The official Exchange Paper to be presented at this Conference on behalf of the Institute of British Foundrymen will be given by Dr. A. L. Norbury, senior metallurgist of the British Cast Iron Research Association. The title of Dr. Norbury's Paper is "Mechanical Properties of Malleable on Various-Sized Test-Bars."

Best flaked orange shellac dissolved in methylated spirits makes a reliable pattern varnish.

A New Commercial Delivery Van.

We recently had the opportunity of inspecting a range of three-wheeled commercial vehicles manufactured by Messrs. Crofts (Engineers), Limited, Thornbury, Bradford. Two models, of 5-cwt. and 10-cwt. carrying capacity, have been standardised. The engine is a water-cooled, two-stroke type, fitted with roller and ball bearings. The type C, which has an 81-mm. bore and an 88-mm. stroke, develops 9 h.p., whilst type R has a 70-mm. bore and a 76-mm. stroke, developing 6 h.p. The machine is provided with three speeds and reverse, and power transmission is effected by a chain drive. Braking is applied simultaneously to all three wheels by the application of a foot pedal. A special feature is that



A New Light Delivery Van by Crofts (Engineers), Limited, Bradford.

the rear wheel can be changed as easily as the front ones by merely unscrewing four bolts. Ignition is effected by a Bosch coil and a 6-volt Exide battery of 30 amp. hours. The cost of the two models is surprisingly low, and an all-in running cost of a penny a mile is confidently anticipated, whilst the tax is but £4 per annum. There must be an important market for such vehicles, and for brass and aluminium founders, foundry-supply houses, we can imagine no handier van for cheaply delivering goods in congested areas. It is a type of car which can be given over to the care of a 16-year-old youth with every confidence.

Correspondence.

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

B.C.I.R.A. Activities.

To the Editor of The Foundry Trade Journal.

Sir,—We notice several points of research proposed by the British Cast Iron Research Association for the programme of the coming twelve months.

May we suggest that a most important point has been omitted, *i.e.*, to assist foundrymen in some way to reduce their cost of manufacture, if only a few pence per lb., by hints as to mixing of scrap and so cheapening the material by this and other methods which are doubtless known to the B.C.I.R.A.

Believe me, it is in this direction that the energies of the Association should be directed—and urgently if they are going to justify their existence.—Yours, etc.,

George Beaufort Richards & Son.

68A, Hilltop,
West Bromwich.
August 7, 1931.

New Zealand.—The Department of Overseas Trade has published a report on Economic Conditions in the Dominion of New Zealand (to March, 1931), by the British Trade Commissioner in New Zealand. Copies (2s. net) may be obtained from the Stationery Office, Kingsway, London, W.C.2.

Trade Talk.

THE METROPOLITAN WATER BOARD proposes to spend £2,346,000 on a five-year programme of developments.

GELLINGS FOUNDRY, LIMITED, are carrying out improvements and alterations to their premises in Victoria Street, Douglas, Isle of Man.

J. & C. HARRISON, LIMITED, have ordered from Lithgows, Limited, Port Glasgow, two cargo ships of 9,000 tons, for service between European and South American ports.

MESSRS. RICHARD DUNSTON, LIMITED, shipbuilders, Thorne, Yorkshire, have received an order for a steam cargo vessel 104 ft. 6 in. in length for service between Grimsby and Hull.

THE ANNUAL GALA and horse and pony show in aid of the Staveley Coal & Iron Company's St. John Ambulance Corps was held in Ringwood Park, near Chesterfield, recently. About 15,000 people were present.

THE FIRST FERRO-ALLOY WORKS in the U.S.S.R. began to operate on July 25 at Cheliabinsk. The works were constructed in one year. Up till now the U.S.S.R. had imported the ferro-alloys required for its industry to the value of £4,000,000 a year.

THE BRITISH ENGINEERS' ASSOCIATION reports that a member-firm, Messrs. Ruston & Hornsby, Limited, of Lincoln, has secured from the Metropolitan Water Board a repeat order for a vertical five-cylinder oil engine for the Honor Oak Pumping Station.

THE LONDON MIDLAND & SCOTTISH RAILWAY COMPANY have placed an order with William Denny & Bros., Limited, Dumbarton, for a new steamer for the Holyhead and Dublin cargo service. The vessel will be almost identical with the "Slieve Bloom," which these constructors built last year for the same company.

THE METROPOLITAN-VICKERS ELECTRICAL COMPANY, LIMITED, in conjunction with the Clyde Crane & Engineering Company, Limited, Mossend, has received the order for the whole of the winches for the Cunarder which is in course of construction at the Clydebank yard of Messrs. John Brown & Company, Limited.

PLYMOUTH CORPORATION is inviting tenders for the supply of foundry products. Standard samples of the articles required will be available for inspection at the Corn Exchange from August 17 to August 25, and tenders have to be delivered to the Town Clerk, Mr. R. J. Fittall, at the Municipal Buildings, by August 26.

IT IS REPORTED from Johannesburg that the South African Manganese Corporation is negotiating with the Beauharnois Power Corporation, of Canada, for the supply of from 100,000 to 200,000 tons of manganese ore annually for a period of from 10 to 15 years, with a view to the establishment of a ferro-manganese industry under the favourable conditions provided by cheap power from Niagara and waterways transport, enabling America to be supplied at competitive rates. The Governments of both South Africa and Canada are said to be sympathetically disposed, and with the co-operation of the steamship companies it is proposed to secure return cargoes of timber and motor-cars.

A NATIONAL CONFERENCE of those engaged in works and factory management is to be held at the Hotel Metropole, London, on Friday, October 2. Mr. Frank Hodges, who is a director of the Securities Management Trust, Limited, will speak on "Works Management as affected by Rationalisation"; Mr. G. E. Rowland, chairman of Agricultural and General Engineers, Limited, on "Factors in Successful Mechanisation," and Mr. Robert Hyde, director of the Industrial Welfare Society, on "Works Managers and Labour Problems." The conference is organised by the British Works Management Association, 68, Victoria Street, London, S.W.1, from whom details may be obtained.

Hints for Commercial Visitors to Czecho-Slovakia.—A memorandum containing hints for the guidance of commercial visitors to Czecho-Slovakia has been prepared from information furnished by the Commercial Secretary to the British Legation at Prague. United Kingdom firms interested may obtain copies of the memorandum on application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1 (quoting Reference No. C3593).

Personal.

MR. A. F. GIBBS has changed his address from 55, Gordon Road, Wanstead, to Fairfield, New North Road, Barkingside, Essex.

MR. JOHN WRIGHT, aged 80, of Welton, near Lincoln, has completed 65 years' service as a moulder with a firm of plough makers.

DR. W. H. HATFIELD, director of the Brown-Firth Research Laboratory, has changed his private address to "Cotefield," Hathersage, Derbyshire. The telephone number is Hathersage 56.

MR. GEORGE H. AUPPERL, consulting metallurgist in the chill- and sand-roll department of the Tobatta Foundry Company, Limited, Tokyo, Japan, is taking up a similar position with the Hyde Park Foundry & Machine Company, Hyde Park, Pennsylvania, U.S.A.

Wills.

HEADLEY, J. E., of Moseley, metal manufacturer	£16,685
MALLABAND, W., formerly foundry foreman of Hadfields, Limited, Sheffield	£13,834
DAWSON, SIR A. TREVOR, a director of Vickers, Limited, and of Vickers-Armstrongs, Limited	£285,910
GASKELL, C., a director and secretary of of Reavell & Company, Limited, Ranelagh Works, Ipswich	£34,938
STRAIN, J., founder and until his retirement chairman of the Lanarkshire Steel Company, Limited, Motherwell	£370,015
BOOTH, J. W., a director of Booth & Brookes, Limited, ironfounders, Mildmay Ironworks, Burnham-on-Crouch	£5,007

Obituary.

MR. G. B. ASTON has died at his home in Wolverhampton. Until his retirement, a few weeks ago, Mr. Aston, who was 72 years of age, held a managerial appointment at the Manor Ironworks, Ettingshall, where he had been employed for over half a century. He was there when the works belonged to Messrs. Stephen Thompson & Company, and he continued when the concern, in 1905, was taken over by Messrs. Joseph Sankey & Sons, Limited.

EX-BAILIE DANIEL JACK, J.P., died suddenly at his residence in Motherwell on August 3, in his 78th year. Mr. Jack started work in the Glasgow Iron Company at the age of ten, and later served an apprenticeship as an iron moulder at the Clydesdale works. In 1871 he entered the employment of Mr. David Colville, when he started the Dalzell malleable-iron works, and eventually became works manager, a position he held until he retired from active duty a few years ago.

Company Meeting.

Warner & Company, Limited.—Presiding at the annual meeting of Messrs. Warner & Company, Limited, Middlesbrough, MR. RALPH SILLARS (chairman and managing director) said that when he spoke at a similar meeting last year he could see no silver lining to the heavy cloud of depression that had prevailed during the previous twelve months. The iron trade since then had become steadily worse, and in consequence they had a very bad year. He could see no signs of an improvement up to the present, although he could not think it would be long delayed. When it did come they were well equipped to take full advantage of it. It had been advisable to transfer £4,000 from the reserve to the profit and loss account. The reserve was built up many years ago for the purpose of meeting such times as these, although they had never had to draw upon it until now.

New Companies.

Birmabright, Limited.—Capital £100. Metal casters, etc. Directors: C. C. Maudslay, North Coker House, Yeovil, and P. Pritchard.

G. N. Higgs (Chromaloid), Limited, Chromaloid Works, Oaklands Road, Cricklewood.—Capital £8,000. Electro deposition of metals, etc.

James Baldwin & Company, Limited.—Capital, £2,000 in £1 shares. Iron and brass founders, etc. Solicitors: Lupton & Fawcett, 26 & 27, Bond Street, Leeds.

A Co-operative Window Display.

The Canadian Government Exhibition Commissioners, Monel-Weir, Limited, and a number of Scottish manufacturers have co-operated in a window display at 107, Hope Street, Glasgow, with the object of demonstrating the large number of industries in which Monel metal is employed. Included in the exhibit are many castings, such as valves, impellers, cocks, yacht fittings and the like. The display, which is illustrated above, has created much interest locally.

AN EXAMPLE OF CO-OPERATIVE PUBLICITY.

Contracts Open.

Boyle, Ireland, August 14.—Centrifugal pumps and electric motors, for the Roscommon County Board of Health. Mr. P. H. McCarthy, consulting engineer, 26, Lower Leeson Street, Dublin. (Fee £2, returnable.)

Cairo, September 10.—Iron and steel materials, for the Central Stores Department of the Ministry of Education, Cairo. The Department of Overseas Trade. (Reference 27,300/31.)

Calcutta, September 9.—Centrifugal pump set, etc., for the Agent, East Indian Railway, Calcutta. The Director-General, India Store Department, Belvedere Road, Lambeth, London, S.E.1. (Fee 5s., non-returnable.)

Colsterworth, August 24.—70 tons of 3-in. and 2-in. cast-iron pipes, etc., for the West Kesteven Rural District Council. Messrs. Sands & Walker, engineers, Milton Chambers, Nottingham. (Fee £2 2s., returnable.)

Johannesburg, August 31.—Pig-iron, for the South African Railways and Harbours. The Department of Overseas Trade. (Reference G.X. 10,606.)

Lisbon.—Cast-iron or steel pipes, etc., for the municipal authorities at Lourinha. The Department of Overseas Trade. (Reference G.X. 10,614.)

Fourth International Conference of Labour Statisticians.—The July issue of the International Labour Review contains an account of this conference which was held in Geneva from May 20 to 23, 1931, besides special articles on "A Theory of Prices and Wages," and on "Workers' Education in Belgium," Reports and Enquiries, Statistics and a bibliography. The Review is published monthly by Messrs. George Allen and Unwin, 30, Museum Street, London, W.C.1. Price 2s. 6d. per month.

Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—The Cleveland ironmasters adhere to the old price-level, in spite of the diminishing volume of business. Although imports of pig-iron from the Midlands and abroad are on the decrease, makers are faced with a further increase in the stocks of unsold iron, unless business soon revives. Some of the furnaces have already been put on to slack blast, and the men at the Lingdale ironstone mine of Messrs. Pease & Partners, Limited, are now working on day-to-day notices, which is not a very promising sign. Cleveland ironmasters are still attempting to unload their surplus stocks on the Scottish market, but are meeting with very severe competition from cheap foreign iron. Prices have been maintained at the same level since the beginning of the year, the minima being:—No. 1 Cleveland foundry iron, 61s. per ton; No. 3 Cleveland G.M.B., 58s. 6d.; No. 4 foundry, 57s. 6d.; and No. 4 forge, 57s. per ton.

In the East Coast hematite market, competition is keen to capture the small volume of business passing. Surplus stocks continue to accumulate, in spite of regular deliveries made against contracts in the Midlands and Sheffield. The market has been falling for so long now that buyers refuse to enter into long contracts, in the hope of future reductions, and only cover their immediate needs. Faced by a decline in both home and foreign markets, the makers seldom realise the nominal price of 61s. per ton, and, indeed, some would not refuse 60s. per ton for a substantial order. On the North-West Coast, hematite makers, in spite of keen competition from the Cleveland district, maintain Bessemer mixed numbers at 66s. per ton at works.

LANCASHIRE.—A few orders are being placed, but the pig-iron market generally is extremely dull. Prices are unaltered. For delivery to users in the Manchester price zone, Staffordshire, Derbyshire and North-East Coast brands of No. 3 iron are on offer at 67s. per ton, with Northamptonshire foundry iron at 65s. 6d., Derbyshire forge at 62s., Scottish No. 3 at 87s. to 87s. 6d., and West Coast hematite iron at about 80s. 6d. per ton.

MIDLANDS.—Most of the foundries have little work in sight, and the market for pig-iron remains poor. It is not anticipated that any revival of business will be forthcoming before the autumn. For delivery to Birmingham and Black Country stations the furnaces still quote 62s. 6d. for Northants No. 3 and 66s. for Derbyshire, North Staffordshire and Lincolnshire No. 3.

SCOTLAND.—Many of the foundries are still closed, while others are working intermittently. The plight of the industry is amply illustrated by the fact that there is only one blast furnace in Scotland still producing pig-iron. Scottish ironfounders are quoting as a fixed minimum price 71s. per ton for No. 3 foundry, f.o.t. furnaces, with a minimum of 2s. 6d. per ton extra for No. 1. The price of Continental No. 3 is 53s., f.o.t. Grangemouth.

Finished Iron.

The market is so weak that even those mills catering for the best section of the trade, marked bars, find difficulty in securing orders. The mills dealing with crown and nut and bolt iron can only find spasmodic employment. Quotations vary according to the type of order, but Staffordshire crown iron is offered between the limits of £9 5s. and £10, while nut and bolt iron is at about £8 10s. Staffordshire marked bars are still at £12 at works. Belgian No. 3 iron, which captures the bulk of the orders for common nut and bolt work, is quoted at about £4 14s., delivered in Staffordshire.

Steel.

The finished-steel market, which is badly hit by the shipbuilding depression, is extremely dull, and few new contracts are being made. A few orders accumulated over the holidays, but these guaranteed only a few days' employment at the most. The market for semi-finished steel is almost completely inactive, in spite of cheap offers by the foreign mills.

Scrap.

The Cleveland market is very poor, and the only transactions are on a very limited scale, the needs of consumers being amply covered. Ordinary heavy cast iron is now quoted at 40s., and good machinery quality at 42s. The same conditions rule in the Scottish market, where heavy machinery scrap, in sizes suitable for foundries, is quoted at 48s. 6d. per ton, and light metal at 35s. per ton. In South Wales the holidays have reduced the market to almost total idleness, and prices are only nominal, in the absence of buying.

Metals.

Copper.—On Tuesday copper touched a new low record at £32 6s. 3d. for standard cash. The copper market is now in a difficult position. The trade demand for the metal is at a standstill pending the publication of the American statistics, which, unfortunately, are expected to show an increase in the stocks on hand. It is, however, doubted whether there will be a decline in the domestic price, for producers will most likely be inclined to leave the market in the hands of the Customs' smelters for some time yet.

Closing quotations :—

Cash.—Thursday, £32 13s. 9d. to £32 15s.; Friday, £32 10s. to £32 12s. 6d.; Monday, £32 10s. to £32 11s. 3d.; Tuesday, £32 6s. 3d. to £32 8s. 9d.; Wednesday, £32 7s. 6d. to £32 8s. 9d.

Three Months.—Thursday, £33 11s. 3d. to £33 12s. 6d.; Friday, £33 8s. 9d. to £33 10s.; Monday, £33 8s. 9d. to £33 10s.; Tuesday, £33 3s. 9d. to £33 5s.; Wednesday, £33 6s. 3d. to £33 7s. 6d.

Tin.—Increased activity is now a feature of the tin market, despite the rather depressing reports of last week. Buying during the past week was more widely distributed, and was attracted by the prospect of a considerable shrinkage in visible stocks this month. Prices, however, are still largely influenced by the general European position, the unsettled outlook restricting the movement of the market.

Official closing prices :—

Cash.—Thursday, £108 10s. to £108 12s. 6d.; Friday, £110 10s. to £110 15s.; Monday, £112 10s. to £112 12s. 6d.; Tuesday, £111 12s. 6d. to £111 15s.; Wednesday, £115 5s. to £115 10s.

Three Months.—Thursday, £111 to £111 2s. 6d.; Friday, £113 2s. 6d. to £113 5s.; Monday, £115 to £115 2s. 6d.; Tuesday, £114 to £114 2s. 6d.; Wednesday, £117 15s. to £118.

Spelter.—There has been a poor demand for the metal. Consumers, both in this country and on the Continent, are content to cover only their immediate requirements. The undertone of the market is firm, although movements are limited by the depressing influence of the general financial position. Galvanising business is still in a most unsatisfactory position.

Daily fluctuations :—

Ordinary.—Thursday, £11; Friday, £11 7s. 6d.; Monday, £11 7s. 6d.; Tuesday, £11 6s. 3d.; Wednesday, £11 7s. 6d.

Lead.—The demand, as is customary at this time of the year, is small, many of the works having closed down for their annual holiday. Cable makers and other consumers are poorly supplied with orders.

The week's prices have been :—

Soft Foreign (Prompt).—Thursday, £12 2s. 6d.; Friday, £12 3s. 9d.; Monday, £12 2s. 6d.; Tuesday, £11 17s. 6d.; Wednesday, £11 16s. 3d.

Age-Hardening of Austenitic Steels.

The following are the conclusions arrived at by Mr. F. R. Hensel (of East Pittsburgh) in a Paper on the above subject, presented at the recent Boston meeting of the American Institute of Mining and Metallurgical Engineers :—

(1) The experiments have shown that the addition of 3 to 5 per cent. titanium or molybdenum above 13 per cent. to a nickel-manganese austenitic base alloy makes it possible to obtain marked precipitation hardening.

(2) Both the titanium and molybdenum age-hardened austenitic alloys remained non-magnetic throughout heat and mechanical treatments.

(3) Ageing was accompanied in the titanium series by pronounced shrinkage, amounting in one case to about 0.18 per cent. in length.

(4) The electrical resistivity of titanium alloys showed an abnormal change in that it first increased and then decreased.

(5) After ageing at 600 deg. C. to maximum hardness, the titanium alloys presented a troostitic appearance.

(6) The X-ray analysis of titanium alloys showed that the lattice constant changed during ageing.

(7) The tensile and elastic properties of the titanium alloys were increased considerably by the precipitation hardening. In one case the elastic limit was raised from 16,500 to 70,000 lbs. per sq. in. with a yield point of about 48 tons per sq. in. Although this increase is connected with a material loss of ductility, the final value of the latter (13.5 per cent. elongation) is high enough to make the material interesting from the engineering standpoint.

(8) The ductility of the titanium alloys was increased in one case from 5.9 to 21.7 per cent. by ageing at 550 deg. C. instead of at 600 deg. C. Lower ageing temperatures therefore give the best tensile properties with such alloys.

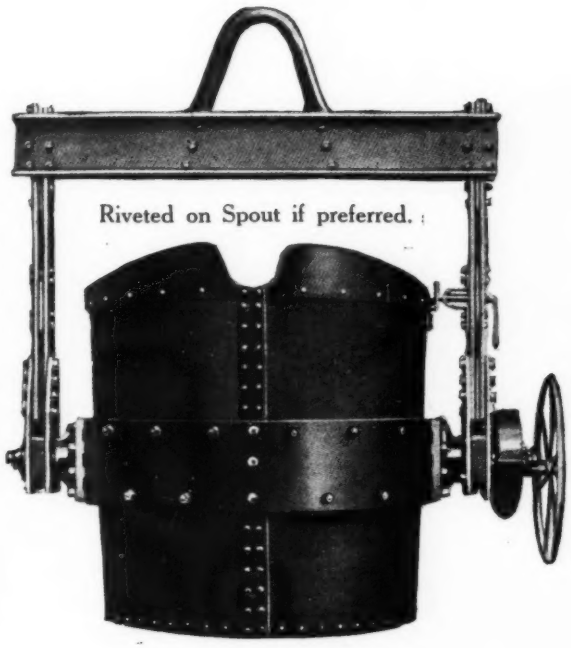
(9) The changes of the tensile properties of the molybdenum series during ageing are not favourable.

Electric Furnace Progress.—Because of recent remarkable progress in the production of resistance material used in the construction of electric furnaces, both Wild-Barfield Electric Furnaces, Limited, and G.W.B. Electric Furnaces, Limited, are now in a position to manufacture and supply certain types and sizes of metallic electric resistance furnaces for working temperatures up to 1,200 deg. C. This important increase in temperature will be of great assistance in very many industries, and will open up new fields for electric furnaces where previously the working temperatures were too high for metallic resistances if a reasonably long life was desired.

CAST IRON FLANGED PIPES
2 in.–12 in. & CONNECTIONS. to 24 in. dia.
WE HAVE FIFTY-TWO YEARS OF ACCUMULATED EXPERIENCE AND METAL PATTERNS.
JAMES & RONALD RITCHIE, LTD.,
Telephone: 3852 (2 Lines). MIDDLESBROUGH. Telegrams: "Ritchie, Middlesbrough."

FACTS about the working efficiency of the

"COLLIN" LADLE



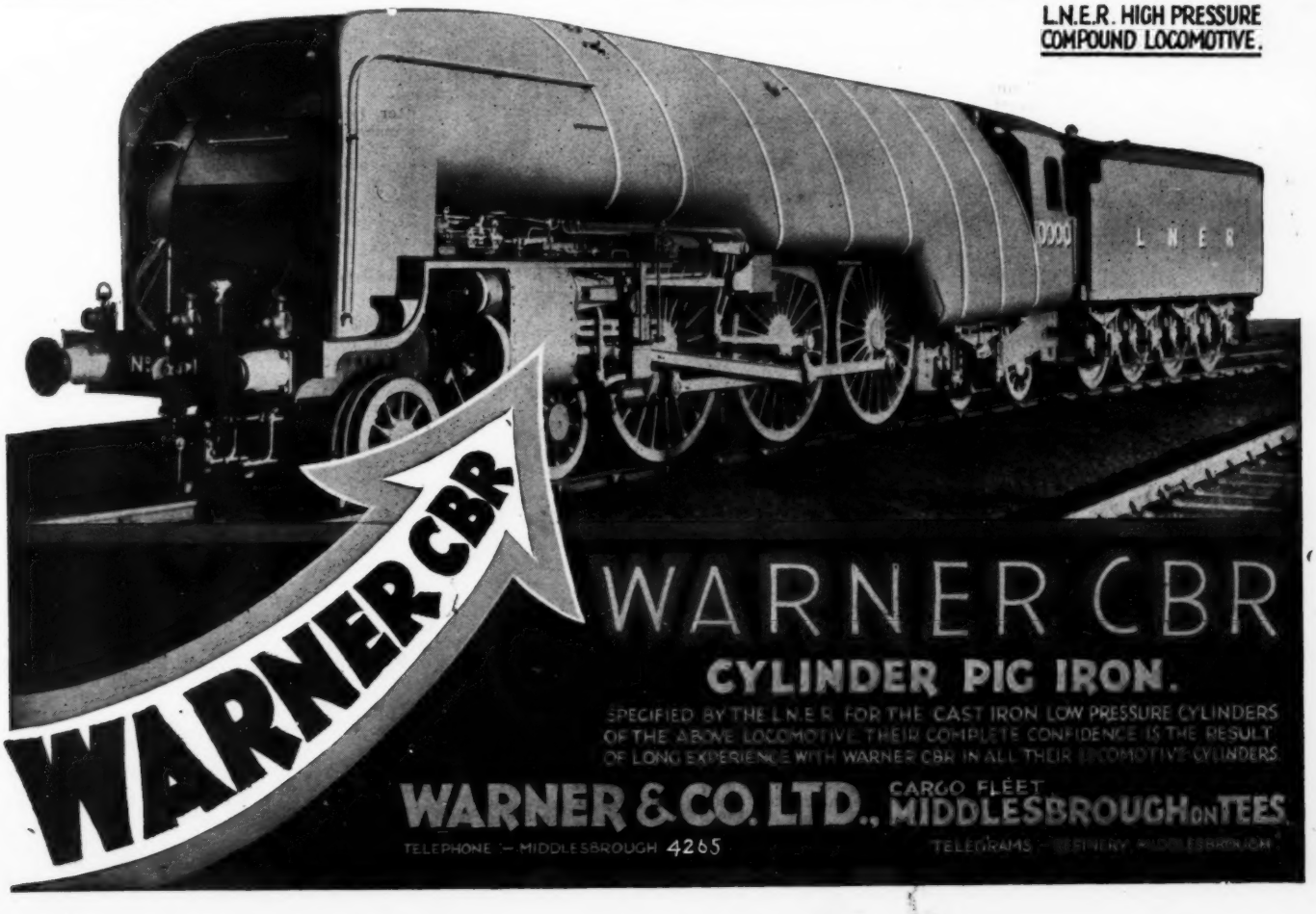
1. It always works perfectly with a minimum effort and gives even pouring without splashing.
2. The Gearing is completely enclosed in a strong oil tight box, the Spindles run in Roller Bearings against Ball Thrust Bearings.
3. The Forged Steel Belt upon which the Gear Box is mounted is built away from the Ladle Body thus forming an Air Gap.
4. This Air Gap Belt is "THE ONLY WAY" to permanently protect the Trunnion Bearings and Gears from distortion and subsequent sticking caused by conducted heat from the Ladle.
5. The Lifting Arms and Cross Beam are built of strong Steel Plates and Sections and are not therefore liable to distortion or breakage.
6. Every customer throughout the world testifies to the efficiency and superiority of the "COLLIN" Ladle.
7. We make Ladles of all sizes and description geared and otherwise for all metals poured in Foundries.

Sole British and Colonial Agents:

JOHN A. SMEETON, LTD.
15, VICTORIA ST., LONDON, S.W.1

'Phone: Victoria 9917. *'Grams: Smeetolim, Sowest, London.*

L.N.E.R. HIGH PRESSURE COMPOUND LOCOMOTIVE.



WARNER CBR

WARNER CBR

CYLINDER PIG IRON.

SPECIFIED BY THE L.N.E.R. FOR THE CAST IRON LOW PRESSURE CYLINDERS OF THE ABOVE LOCOMOTIVE. THEIR COMPLETE CONFIDENCE IS THE RESULT OF LONG EXPERIENCE WITH WARNER CBR IN ALL THEIR LOCOMOTIVE CYLINDERS

WARNER & CO. LTD., CARGO FLEET MIDDLESBROUGH ON TEES.

TELEPHONE — MIDDLESBROUGH 4265 TELEGRAMS — REFINERY, MIDDLESBROUGH

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	32	7	6
Three months	33	6	3
Electrolytic	35	0	0
Tough	33	0	0
Best selected	33	10	0
Sheets	64	0	0
India	44	0	0
Wire bars	37	2	6
Do., September	37	2	6
Do., October	37	2	6
Ingot bars	37	2	6
H.C. wire rods	37	10	0
Off. av. cash, July	34	9	1 1/16
Do., 3 mths., July	35	3	7 1/16
Do., Sttlmnt., July	34	9	2 3/16
Do., Electro, July	37	19	4 5/16
Do., B.S., July	36	5	10
Do., wire bars, July	38	12	9 5/16
Solid drawn tubes			10d.
Brazed tubes			10d.
Wire			6½d.

BRASS.

Solid drawn tubes	9d.
Brazed tubes	11d.
Rods, drawn	7¼d.
Rods, extd. or rlld.	5d.
Sheets to 10 w.g.	7¾d.
Wire	7¾d.
Rolled metal	6¾d.
Yellow metal rods	4¾d.
Do. 4 × 4 Squares	5¼d.
Do. 4 × 3 Sheets	5¼d.

TIN.

	£	s.	d.
Standard cash	115	5	0
Three months	117	15	0
English	116	10	0
Bars	118	5	0
Straits	116	7	6
Australian	116	2	6
Eastern	121	5	0
Banca	119	12	6
Off. av. cash, July	111	11	1 1/16
Do., 3 mths., July	113	9	7 1/16
Do., Sttlmt., July	111	11	3 1/16

SPELTER.

	£	s.	d.
Ordinary	11	7	6
Remelted	10	15	0
Hard	8	12	6
Electro 99.9	13	12	6
English	11	17	6
India	11	0	0
Zinc dust	19	0	0
Zinc ashes	2	15	0
Off. aver., July	12	10	9 15/16
Aver. spot, July	12	5	7 5/16

LEAD.

	£	s.	d.
Soft foreign ppt.	11	16	3
English	13	5	0
Off. average, July	12	16	3 1/16
Average spot, July	12	14	7 1/16

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	20	0	0
Do., V.M. ex-whf.	19	5	0
Rods	22	0	0
Boiler plates	14	0	0
Battery plates	15	15	0

ANTIMONY.

	£	s.	d.
Special brand, Eng.	34	0	0
Chinese	22	5	0
Crude	21	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	16	15	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£7 7 6
45/50%	£10 7 6
75%	£15 2 6
Ferro-vanadium—	
35/50%	12/8 lb Va.
Ferro-molybdenum—	
70/75% c. free	4/2 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	9½d. lb.
Ferro-phosphorus, 20/25%	£15 10 0
Ferro-tungsten—	
80/85%	1/8½ lb.
Tungsten metal powder—	
98/99%	1/11½ lb.
Ferro-chrome—	
2/4% car.	£28 0 0
4/6% car.	£21 5 0
6/8% car.	£20 12 6
8/10% car.	£19 17 6
Ferro-chrome—	
Max. 2% car.	£29 17 6
Max. 1% car.	£33 15 0
Max. 0·70% car.	£35 12 6
70% carbon-free	9½d. lb.
Nickel—99% £170 0 0 to £175 0 0	
Ferro-cobalt	8/9 lb.
Aluminium 98/99%	£85 0 0
Metallic chromium—	
96/98%	2/7 lb.
Ferro-manganese (net)—	
76/80% loose £10 15 0 to £11 5 0	
76/80% packed £11 15 0 to £12 5 0	
76/80% export (nom.) £9 0 0	
Metallic manganese—	
94/96% carbonless	1/3 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	£0 2 0
Finished bars, 18% tungsten	£0 2 9

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 3/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

South Wales	£	s.	d.	£	s.	d.
Heavy steel				2	0	0
Bundled steel and shrngs.	1	14	0	to 1	18	0
Mixed iron and steel	1	14	0	to 1	16	0
Heavy cast iron	2	0	0	to 2	2	6
Good machinery for foundries				2	5	0

Cleveland—	£	s.	d.
Heavy steel	1	17	6
Steel turnings	1	5	0
Cast-iron borings	1	2	0
Heavy forge	2	10	0
W.I. piling scrap	2	2	6
Cast-iron scrap	2	0	0 to 2 2 0

Midlands—	£	s.	d.
Light cast-iron scrap	1	17	6
Heavy wrought	2	5	0
Steel turnings		—	

Scotland—	£	s.	d.
Heavy steel	1	17	6
Ordinary cast iron	2	3	6
Engineers' turnings	1	7	6
Cast-iron borings	1	10	0
Wrought-iron piling	2	7	6
Heavy machinery	2	8	6

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	26	0	0
Brass	18	0	0
Lead (less usual draft)	10	0	0
Tea lead	7	0	0
Zinc	5	10	0
New aluminium cuttings	52	0	0
Braziery copper	23	0	0
Gunmetal	23	0	0
Hollow pewter	72	0	0
Shaped black pewter	53	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	61/-
Foundry No. 3	58/6
Foundry No. 4	57/6
Forge No. 4	57/-
Hematite No. 1	61/6
Hematite M/Nos.	61/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	71/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands—	
Staffs common*	—
,, No. 4 forge*	61/-
,, No. 3 fdry.*	66/-
Shrops basic	—
,, Cold blast, ord.	—
,, ,, roll iron	—
Northants forge*	57/6
,, fdry. No. 3*	62/6
,, fdry. No. 1*	65/6
Derbyshire forge*	61/-
,, fdry. No. 3*	66/-
,, fdry. No. 1*	69/-
,, basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	73/6
,, No. 3	71/-
Hem. M/Nos. d/d	70/-
Sheffield (d/d district)—	
Derby forge	58/6
,, fdry. No. 3	63/6
Lincs forge	—
,, fdry. No. 3	63/6
E.C. hematite	76/-
W.C. hematite	81/6
Lancashire (d/d eq. Man.)—	
Derby forge	62/-
,, fdry. No. 3	67/-
Staffs fdry. No. 3	67/-
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	87/- to 87/6
Clyde, No. 3	87/- to 87/6
Monkland, No. 3	87/- to 87/6
Summerlee, No. 3	87/- to 87/6
Eglinton, No. 3	87/- to 87/6
Gartsherrie, No. 3	87/- to 87/6
Shotts, No. 3	87/- to 87/6

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.)	9	15	0	to 10	0	0
Nut and bolt iron	8	5	0	to 8	10	0
Hoops	10	10	0	to 12	0	0
Marked bars (Staffs) f.o.t.				12	0	0
Gas strip	10	10	0	to 12	0	0
Bolts and nuts, ¾ in. × 4 in.				12	5	0

Steel—	£	s.	d.	£	s.	d.
Plates, ship, etc.	8	15	0	to 8	17	6
Boiler plts.	9	0	0	to 9	15	0
Chequer plts.				10	7	6
Angles				8	7	6
Tees				9	7	6
Joists				8	15	0
Rounds and squares, 3 in. to 5½ in.				9	7	6
Rounds under 3 in. to ¾ in. (Untested)	6	12	6	& up.		
Flats—8 in. wide and over				8	12	6
,, under 8 in. and over 5 in.				8	17	6
Rails, heavy	8	5	0	to 8	10	0
Fishplates				12	0	0
Hoops (Staffs)				9	5	0
Black sheets, 24g.	8	5	0	to 9	5	0
Galv.cor.shts.24g.	9	7	6	to 9	15	0
Galv. flat sheets	9	17	6	to 10	5	0
Galv. fencing wire, 8g. plain				12	0	0
Billets, soft	4	17	6	to 5	5	0
Billets, hard				6	12	6
Sheet bars	4	12	6	to 4	17	6
Tin bars				4	12	6

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	10½d.
Sheet to 10 w.g.	11½d.
Wire	12d.
Rods	11½d.
Tubes	1/6d.
Castings	11½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
3/- to 10 g.	1/4½ to 1/11½

with extras according to gauge.

Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	17.01
No. 2 foundry, Valley	17.00
No. 2 foundry, Birm.	12.00
Basic	17.26
Bessemer	18.76
Malleable	18.76
Grey forge	18.26
Ferro-mang. 80%	85.00
O.-h. rails, h'y, at mill	43.00
Billets	29.00
Sheet bars	29.00
Wire rods	35.00
	Cents.
Iron bars, Phila.	2.09
Steel bars	1.60
Tank plates	1.65
Beams, etc.	1.65
Skelp, grooved steel	1.60
Skelp, sheared steel	1.65
Steel hoops	1.80
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	2.90
Wire nails	1.80
Plain wire	2.20
Barbed wire, galv.	2.55
Tinplates, 100-lb. box	$5.00

COKE (at ovens).

Welsh foundry	20/- to 25/-
,, furnace	15/-
Durham and Northumberland—	
,, foundry	13/- to 14/-
,, furnace	13/-
Midlands, foundry	—
,, furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 box	13/3 to 13/6
,,	28×20 ,,	26/6
,,	20×10 ,,	19/1½
,,	18¾×14 ,,	14/-
C.W.	20×14 ,,	12/9
,,	28×20 ,,	25/6
,,	20×10 ,,	18/10½
,,	18¾×14 ,,	14/-
Terneplates	28×20	26/6 per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6 0 0 to £7 0 0
Bars, hammered, basis	£16 10 0 to £17 0 0
Bars and nail-rods, rolled, basis	£15 17 6 to £16 5 0
Blooms	£10 0 0 to £12 0 0
Keg steel	£32 0 0 to £33 0 0
Faggot steel	£18 0 0 to £23 0 0
Bars and rods dead soft, st'l	£10 0 0 to £12 0 0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.

Current Discounts.

	Tubes.	*Fittings.*
Gas	62½%	57½%
Water ..	58½%	52½%
Steam ..	55%	47½%

W.I. 12½% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.	
Aug.	6 ..	32	13	9	dec. 1/3
,,	7 ..	32	10	0	,, 3/9
,,	10 ..	32	10	0	No change
,,	11 ..	32	6	3	dec. 3/9
,,	12 ..	32	7	6	inc. 1/3

Electrolytic Copper.

		£	s.	d.	
Aug.	6 ..	35	0	0	No change
,,	7 ..	35	0	0	,, ,,
,,	10 ..	35	0	0	,, ,,
,,	11 ..	35	0	0	,, ,,
,,	12 ..	35	0	0	,, ,,

Standard Tin (cash).

		£	s.	d.	
Aug.	6 ..	108	10	0	dec. 10/-
,,	7 ..	110	10	0	inc. 40/-
,,	10 ..	112	10	0	,, 40/-
,,	11 ..	111	12	6	dec. 17/6
,,	12 ..	115	5	0	inc. 72/6

Tin (English ingots).

		£	s.	d.	
Aug.	6 ..	109	10	0	dec. 35/-
,,	7 ..	111	10	0	inc. 40/-
,,	10 ..	113	10	0	,, 40/-
,,	11 ..	112	15	0	dec. 15/-
,,	12 ..	116	10	0	inc. 75/-

Zinc Sheets (English).

		£	s.	d.	
Aug.	6 ..	20	10	0	No change
,,	7 ..	20	10	0	,, ,,
,,	10 ..	20	10	0	,, ,,
,,	11 ..	20	0	0	dec. 10/-
,,	12 ..	20	0	0	No change

Spelter (ordinary).

		£	s.	d.	
Aug.	6 ..	11	0	0	dec. 3/9
,,	7 ..	11	7	6	inc. 7/6
,,	10 ..	11	7	6	No change
,,	11 ..	11	6	3	dec. 1/3
,,	12 ..	11	7	6	inc. 1/3

Lead (English).

		£	s.	d.	
Aug.	6 ..	13	10	0	dec. 5/-
,,	7 ..	13	10	0	No change
,,	10 ..	13	10	0	,, ,,
,,	11 ..	13	5	0	dec. 5/-
,,	12 ..	13	5	0	No change

AVERAGE MONTHLY PRICES OF CLEVELAND No. 3 PIG-IRON.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1887	37 5	35 10	34 4	34 4	34 1	34 10	34 4	34 5	33 9	31 10	31 8	33 6	34 2
1888	32 2	31 1	31 5	31 9	30 11	31 5	32 4	33 5	34 8	34 2	33 1	33 10	32 7
1889	33 8	35 0	37 5	38 9	38 6	37 10	40 1	43 4	44 1	51 5	64 7	61 1	43 10
1890	60 3	53 1	51 0	47 4	42 2	41 5	43 2	45 7	47 9	47 10	47 4	43 1	47 6
1891	42 1	41 10	39 9	38 7	40 9	41 0	40 8	39 8	40 4	39 11	38 8	38 1	40 1
1892	37 7	35 7	36 10	37 10	39 2	40 11	39 11	39 10	40 0	38 6	37 6	37 4	38 5
1893	36 0	34 3	34 4	34 2	33 10	34 8	35 3	35 5	35 4	34 8	34 7	35 9	34 10
1894	35 8	35 11	36 1	36 1	35 5	35 5	35 5	35 11	36 6	35 8	35 8	35 1	35 9
1895	34 7	34 4	34 4	34 8	35 6	35 2	36 1	37 1	38 10	38 6	37 11	37 6	36 3
1896	37 3	38 4	38 7	38 1	37 4	37 4	36 11	36 11	37 11	39 2	40 5	40 5	38 3
1897	41 2	40 4	40 5	39 2	39 7	40 9	39 6	40 5	41 7	42 5	41 5	40 4	40 7
1898	40 9	40 8	40 6	40 0	40 7	39 11	40 4	41 11	43 0	44 11	49 1	44 3	42 0
1899	46 10	47 11	47 9	49 10	55 11	62 10	71 6	65 9	67 7	68 8	70 0	66 9	60 5
1900	67 10	68 10	73 10	76 2	74 2	68 6	69 3	71 4	70 9	67 8	63 6	53 6	68 9
1901	48 0	46 6	45 8	45 5	45 10	44 7	44 6	45 3	45 3	45 3	43 6	43 1	45 3
1902	43 11	46 7	46 9	47 11	48 10	49 7	50 9	52 1	53 6	52 9	50 9	47 11	49 3
1903	47 3	48 9	51 10	49 0	46 1	46 2	46 7	46 8	45 7	43 6	42 10	41 11	46 4
1904	42 3	42 7	43 3	44 7	44 0	42 10	42 9	43 3	43 1	43 9	46 1	48 7	43 11
1905	48 11	48 0	49 6	50 1	51 5	45 6	45 9	47 5	48 8	52 11	52 9	53 3	49 6
1906	53 9	50 1	48 1	48 8	50 2	50 3	50 6	53 0	54 6	56 8	58 6	62 4	53 6
1907	60 4	56 6	54 10	56 0	61 1	58 1	57 8	57 8	55 7	54 8	50 8	50 0	56 2
1908	48 5	49 3	51 7	51 10	51 6	51 2	50 0	51 4	52 0	49 8	49 4	48 11	50 8
1909	48 10	48 1	46 9	47 9	48 4	48 9	48 6	50 5	51 3	51 11	51 2	50 7	49 4
1910	51 10	51 3½	51 7½	50 10	49 10	49 2	48 10	49 8½	49 3½	49 7½	49 6½	49 10	50 4
1911	49 11½	49 2½	48 5	46 11	46 4	46 6	46 11½	47 4	47 0	46 7	47 4½	48 1	47 7
1912	50 0	49 5½	51 1½	53 7½	54 4	55 1	57 5½	64 6½	61 7½	66 8½	67 8	68 0	58 5½
1913	66 11½	63 8½	64 8	67 1½	66 3	56 9½	56 3½	55 8	55 4	53 0	50 1	50 4	58 10
1914	50 11	51 5½	51 0½	51 4½	51 6	51 6½	51 5	52 3	51 5	50 1	50 3	53 0	51 4½
1915	55 7	56 6	61 0	66 7	65 2	66 10	65 4	66 0½	65 3	65 11	69 10½	75 7½	65 7
1916	80 2	91 6	87 4½	86 10	82 6	82 6	87 6	87 6	87 6	87 6	87 6	87 6	85 10
1917	87 6	87 6	87 6	92 6	92 6	92 6	92 6	92 6	92 6	92 6	92 6	95 0	99 3
1918	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0
1919	95 0	95 0	95 0	95 0	152 6	160 0	160 0	160 0	160 0	160 0	160 0	160 0	157 8
1920	175 0	175 0	187 6	200 0	208 0	217 6	217 6	221 0	225 0	225 0	225 0	225 0	209 3
1921	222 6	195 0	150 0	126 0	120 0	120 0	120 0	136 3	127 0	120 0	110 0	100 0	137 4
1922	92 6	90 0	90 0	90 0	90 0	90 0	89 0	87 3	92 6	92 6	92 6	91 3½	90 7½
1923	94 6	108 9	125 6	129 4½	128 5	136 0	128 1½	121 11	97 1½	97 0	100 0	100 0	110 6½
1924	99 10	97 3½	91 9	93 9	91 9	89 10½	87 9	85 0	82 5½	80 2½	81 9	81 9	88 7½
1925	80 4½	78 10½	78 0	78 3	76 0	73 10½	71 7½	69 10½	68 1½	66 7½	66 0	66 10½	72 10½
1926	69 4½	70 0	70 0	70 0	72 6	75 10½	86 7½	90 0	93 10½	117 10	120 0	99 0	86 5
1927	85 0	83 1½	81 0	80 0	73 9	70 0	70 0	68 9	67 6	67 6	66 10½	65 0	73 2½
1928	65 0	65 0	65 6	66 0	66 0	66 0	66 0	66 0	66 0	66 0	66 0	66 0	65 9½
1929	66 0	66 9	67 0	68 1½	69 5	71 10½	72 9	72 6	72 6	72 6	72 6	72 6	70 4½
1930	72 6	72 6	70 0	67 6	67 6	67 6	67 6	64 6	63 6	63 6	63 6	63 6	66 11½
1931	59 6	58 6	58 6	58 6	58 6	58 6	58 6	—	—	—	—	—	—

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

18, BENNETTS HILL, BIRMINGHAM.
13, RUMFORD STREET, LIVERPOOL.

PIG IRON

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

19, ST. VINCENT PLACE, GLASGOW.

ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

EXPERIENCED Green- or Dry-sand Moulder seeks situation; life experience in foundry work, cupola, etc.; willing to accept reduced wage for something like regular work; appreciation and keen interest given to a reliable firm.—"Mold," Box 862, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

METAL Moulder, experienced as Foreman and Under-Foreman, requires position as Foreman, small foundry, England or abroad.—Box 858, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

WANTED, Qualified Metallurgist, to take control of ironfounders' laboratory.—Apply by letter, giving age and full particulars of experience and qualifications, to Box 852. Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of The Foundry Trade Journal.

Any Member, Associate Member or Associate of the Institute of British Foundrymen who desires his qualifications to be inserted in the column must forward to the General Secretary of the Institute the following information:—(a) Name and address; (b) name of present employer (or last employer if unemployed); (c) brief particulars of qualifications, experience, and type of position required. The name will not be disclosed until the candidate is in communication with a prospective employer. Announcements will be inserted in two successive issues, unless announcers' requirements have been met with in the meantime.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

The Institute of British Foundrymen and the Proprietors of The Foundry Trade Journal wish it to be clearly understood that they accept no legal responsibility in connection with this service, for which no charge is made to members of the I.B.F.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester.

FOREMAN Steel Moulder at liberty. Excellent record; light work and also heavy up to 95 tons. Converters, Siemen's, electric and crucible; familiar with all up-to-date practice. (135)

COMMERCIAL Manager to well-known firm of iron, steel and malleable founders requires similar position, or as representative. Works and D.O. experience and costing. (136)

FOUNDRY Manager or Head Foreman desires position. Modern and progressive, thoroughly practical. Sound technical knowledge. Of proved ability. High-class internal-combustion engines. Electrical and general engineering. (137)

FOUNDRY Foreman requires re-engagement. Extensive experience, high-class brass-foundry work, also as iron-foundry foreman. Marine engineering, oil engines and turbines. (138)

SITUATIONS VACANT AND WANTED—*Contd.*

YOUNG Foundryman, good general and technical education, requires position. Has served full apprenticeship, worked as moulder, and has held position as assistant to foundry manager. (139)

OPEN for Appointment, Engineer (A.M.I.Mech.E.), with exceptional experience in reorganisation and management of foundry, workshops, etc., where reduction of costs is desired, along with experience in design, foundry, machine shops, costing, sales, executive duties, in both small and large modern works. (140)

PROPERTY.

MAGNIFICENT

11 ACRES WORKS SITE.

SHEFFIELD.

145,000 Sq. Ft. of Shops.

SIDING CONNECTIONS

with L.M. & S. and L. & N.E. Rlys.

WELL-BUILT & COMMODIOUS OFFICES

Will Sell whole or in lots to suit customers or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—

THOS. W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

PUBLICATION

RYLAND'S DIRECTORY of the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades. A new edition will be published next January. Secure your advertising space now. Rates on application.—Industrial Newspapers, Ltd., 49, Wellington Street, Strand, London, W.C.2. Telephone: Temple Bar 3951 (5 lines).

MACHINERY.

SAND MIXERS.—New and Secondhand. Ask us to quote.—W. Brealey & Company, Limited, Station Works, Ecclesfield, Sheffield.

THOS. W. WARD, LTD.

ROBINSON 30-in. Plane-Iron Grinder.

JANVIER Die-Copying Machine, with 8 faceplates up to 24 in. dia.

"EVER-READY" Electric Table Surface Grinders, 14-in. and 20-in. dia. stones.

B.S.A. Centreless Grinders, for work about 1 in. dia. x 6½ in. long.

1928 make 3-ton LOCO. STEAM CRANE (Coles), 35-ft. jib; 4-ft. 8½-in. gauge; 80 lbs. w.p.

30-cwt. STEAM TRAVELLING GANTRY JIB CRANES (Coles), 50-ft. jib; to lift 30 cwts. at 42-ft. radius.

Good Secondhand BABCOCK & WILCOX WATER-TUBE BOILER, of 4,356 ft. of heating surface, re-insurable at a working pressure of 150 lbs. per sq. in., with chain-grate stoker, etc.

LANCASHIRE BOILER, 30 ft. 0 in. x 8 ft. 6 in., re-insure 120 lbs. pressure.

(ASK FOR "ALBION" MACHINERY CATALOGUE.)

ALBION WORKS, SHEFFIELD.

MISCELLANEOUS.

GANISTER, best quality for cupolas, also for Steel Works.—Astbury Silica Company, "The Brooms," Park Lane, Congleton.

STRAW ROPES.—Manufacturers wish connection with importers and large users.—Reply to Box 860, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

MISCELLANEOUS—*Continued.*

'Phone: 287 SLOUGH

SAND PLANT

IN STOCK

Small Jackman SM4 Aerator...	£12
Halls "Invincible" Mixer ...	£18
"Herbert" Mixer, as new ...	£32
All above BALL BEARING.	
4 ft. 6 in. "Evans" Sandmill ...	£20
5 ft. Universal Sandmill... ...	£26
6 ft. "Jackman" Sandmill ...	£38
Pneulec Oilsand Mixer, type PM	£14
Jackman Rotary Sifter	£8

ALEX. HAMMOND, *Foundry Machinery Merchant,*
14, AUSTRALIA ROAD, SLOUGH

Bradley's

THE ORIGINAL MAKERS OF

DEGASIFIED

REFINED

PIG IRONS

FOR

ALL CLASSES OF HIGH-DUTY CASTINGS

BRADLEY & FOSTER Ltd.
DARLASTON
STAFFS.

TELEPHONE: DARLASTON 16 (P.B. EX)

PETER—WITH ONE EXCEPTION

With one exception Peter is an ordinary little fellow. Chubby, likeable, just five-and-a-half, full of life and fun, and on occasions—be it admitted—of naughtiness. Just now Peter's rather important, for this is his first term at school, and he's grappling with the intricacies of "A B C" and "Twice-Two": difficult subjects to all men of five-and-a-half, but even more difficult in Peter's case because—bad luck—he's totally blind. That's his One Exception. Peter learns reading, writing, and 'rithmetic through the medium of "Braille"—dull stuff compared with the coloured picture books of most five-and-a-halfs. However, he's a stout lad is Peter, and he's making great progress.

Would you like to know more about him? How, in spite of his "One Exception," he is being educated and, when older, technically trained and usefully employed.

There is a long waiting list of "Peters" throughout the British Isles, for whom training and accommodation must be provided in the immediate future.

Will you help with a donation or annual subscription? Any sum, large or small, will be gratefully received.

Here's a suggestion. Your eyesight is worth 3d. a year to you. Send Peter and his handicapped pals 3d. for every year you've had it. Now, please, in case it slips your memory. Good idea?

The Chairman,

SCHOOL FOR THE BLIND
(FOUNDED 1838)
SWISS COTTAGE, LONDON, N.W. 3